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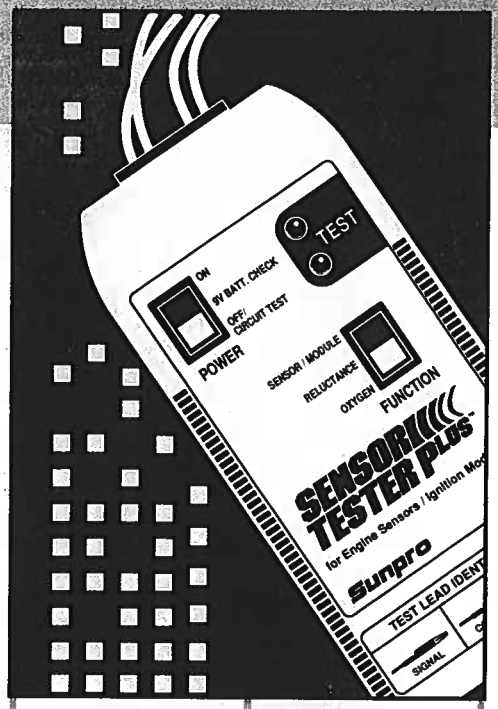


CP9080

SENSOR TESTER PLUS™

Instructions in English and Spanish

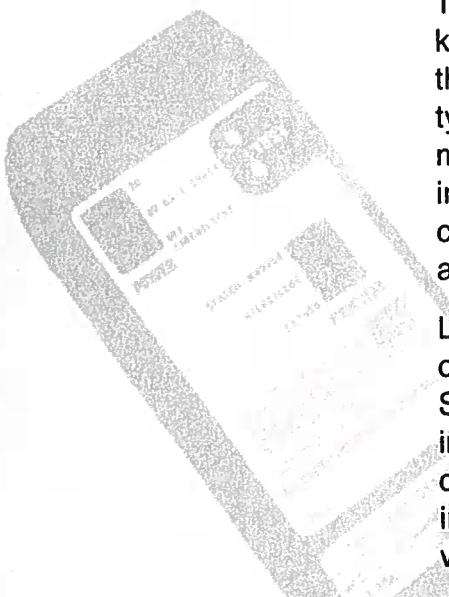
Instrucciones en Español e Inglés

Introduction

Sunpro®

SENSOR TESTER PLUS™

Vehicle Sensor and Ignition Module Tester



Congratulations on purchasing your Sunpro Sensor Tester Plus for testing vehicle sensors, ignition modules and more. Your Sunpro Sensor Tester Plus is made by Actron, the largest and most trusted name in automotive diagnostic equipment for the home mechanic.

This instruction manual is divided into several key sections. You will find detailed steps on using the the Sensor Tester Plus for checking many types of vehicle sensors, idle speed control motors and ignition modules. Also included is important information about sensor operation, common problems which occur if the sensors fail, and troubleshooting tips.

Locating drivability problems requires inspection of both mechanical and electronic parts. The Sensor Tester Plus is valuable for finding failures in many important electronic components. You can save yourself a lot of costly time and money in auto repair. And feel confident that your vehicle's problem has been fixed!

Sunpro offers a complete line of high quality automotive diagnostic and repair equipment. See your local dealer for other Sunpro products.

All information, illustrations and specifications contained in this manual are based on the latest information available from industry sources at the time of publication. No warranty (expressed or implied) can be made for its accuracy or completeness, nor is any responsibility assumed by Actron Manufacturing Co. or anyone connected with it for loss or damages suffered through reliance on any information contained in this manual or misuse of accompanying product. Actron Manufacturing Co. reserves the right to make changes at any time to this manual or accompanying product without obligation to notify any person or organization of such changes.

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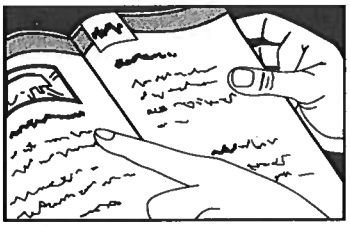
Vehicle Service Info

The following is a list of publishers who have manuals containing electronic engine control, ignition system and related information. Some manuals may be available at auto parts stores or your local public library. For others, you need to write for availability and prices, specifying the make, style and model year of your vehicle.

Vehicle Service Manuals



Chilton Book Company
Chilton Way
Radnor, PA 19089

Haynes Publications
861 Lawrence Drive
Newbury Park, CA 91320

"Electronic Engine Controls"
"Fuel Injection and Feedback Carburetors"
"Fuel Injection and Electronic Engine Controls"
"Emissions Control Manual"
...or similar titles

Cordura Publications
Mitchell Manuals, Inc.
Post Office Box 26260
San Diego, CA 92126

Motor's Auto Repair Manual
Hearst Company
250 W. 55th Street
New York, NY 10019

Service manuals from General Motors Corporation

Buick
Tuar Company
Post Office Box 354
Flint, MI 48501

Oldsmobile
Lansing Lithographers
Post Office Box 23188
Lansing, MI 48909

Cadillac, Chevrolet, Pontiac
Helm Incorporated
Post Office Box 07130
Detroit, MI 48207

All GM manuals: Ignition system information in Section 6D. Electronic engine control information in Section 6E.

Service manuals from Ford Motor Company

Ford Publication Department
Helm Incorporated
Post Office Box 07150
Detroit, MI 48207

1985 & Newer: "Emission Diagnosis Engine/ Electronics"
1981 - 1984: "Engine/Emissions Diagnosis"
1980: "Engine Diagnosis/Emissions"

Service manuals from Chrysler Corporation

Chrysler Corporation
Dyment Distribution Service
Service Publication
12200 Alameda Drive
Strongsville, Ohio 44136

Safety First

General Safety Guidelines to Follow When Working on Vehicles

- Always wear approved eye protection.
- Always operate the vehicle in a well ventilated area. Do not inhale exhaust gases - they are very poisonous!
- Always keep yourself, tools and test equipment away from all moving or hot engine parts.
- Always make sure the vehicle is in **park** (Automatic transmission) or **neutral** (manual transmission) and that the **parking brake is firmly set.** Block the drive wheels.
- Never lay tools on vehicle battery. You may short the terminals together causing harm to yourself, the tools or the battery.
- Never smoke or have open flames near vehicle. Vapors from gasoline and charging battery are highly flammable and explosive.
- Never leave vehicle unattended while running tests.
- Always keep a fire extinguisher suitable for gasoline/electrical/chemical fires handy.
- Always turn ignition key OFF when connecting or disconnecting electrical components, unless otherwise instructed.
- Always follow vehicle manufacturer's warnings, cautions and service procedures.

CAUTION:
Some vehicles are equipped with safety air bags. You *must* follow vehicle service manual cautions when working around the air bag components or wiring. If the cautions are not followed, the air bag may open up unexpectedly, resulting in personal injury. Note that the air bag can still open up several minutes after the ignition key is off (or even if the vehicle battery is disconnected) because of a special energy reserve module.

Section 1

What Does the Sensor Testor Plus Do?

The Sensor Tester Plus is a versatile tool designed to test several important components in vehicle electronic systems. All of the uses listed below are explained in this manual.

Sensor Testing

- Check temperature sensors (engine coolant, incoming air.)
- Check potentiometer type sensors (throttle position, EGR valve position, vane air flow.)
- Check knock sensors.
- Check oxygen sensors.
- Check Hall effect type sensors (crankshaft position, camshaft position.)
- Check magnetic reluctance type sensors (crankshaft position, camshaft position, wheel speed.)

Computer controlled engines require good sensors for proper operation. Many computer trouble codes, obtained with a Sunpro Code Scanner or other means, refer to sensor circuit problems. Sensor failure is often the cause. The Sensor Tester Plus can check for these failures.

Ignition Module Testing

Most vehicles built in the '70's and '80's have some form of electronic ignition system. Two critical parts of these systems are the ignition module and the pick-up assembly. Failures in either of these two parts can cause a No-Start condition. The Sensor Tester Plus can check for these problems.

DC Idle Speed Control Motor Testing

Many computer controlled engines use this component. Hard starting, stalling and improper idle can be caused if this part fails. The Sensor Tester Plus checks this component quickly and easily.

Circuit Voltage Testing

The Sensor Tester Plus can act as a low powered "circuit test" light. That is, it detects the presence of voltage on a connector, fuse, wiring, etc. by lighting up a light. Many vehicle troubleshooting procedures use this handy function.

Continuity Testing

- Check wires for open circuit failures.
- Check ground connections.
- Check switch operation.

Checking wiring and connectors is an important part of any good electronic troubleshooting procedure.

Diode Testing

The Sensor Tester Plus can check diodes for proper operation. Bad diodes in an alternator can cause starting/charging system problems.

Section 2 Tester Basics

Sensor Tester Plus Controls and Accessories

IMPORTANT: Moisture condensation can temporarily disturb the precision circuitry in the Sensor Tester Plus. Wait 15 minutes before using tester if it is transferred from a cold area to a warm area.

Note: Described here is WHAT the controls do. Other manual sections detail HOW to use the unit for various tests.

(1) POWER Switch

This switch controls power to the tester and the RED test leads.

- **OFF / CIRCUIT TEST** - No power is supplied to either the tester or the RED test leads.

  Unit functions as "circuit tester" when POWER switch is in this position, regardless of FUNCTION switch position. Refer to "Circuit Tester" in Section 6 for details.

- **9V BATT. CHECK** - Checks voltage of 9 volt battery inside tester. Brightness of the lower TEST light indicates battery strength. Also, voltage from 9 volt battery is supplied to RED test leads.

- **ON** - Tester is powered up and ready for use. Voltage from 9 volt battery is supplied to RED test leads.

(2) FUNCTION Switch

This switch selects the type of test being performed.

- **SENSOR/MODULE** - Switch position for most tester uses except reluctance, knock and oxygen type sensor checks.
- **RELUCTANCE** - For testing either magnetic reluctance or knock type sensors.
- **OXYGEN** - For testing oxygen type sensors.

③ TEST Lights

Used to indicate results of various tests and checks. One or both lights will have *on*, *off* or *variable* brightness (depending upon test type).

④ Test Leads

Two or more of these are used for the various tests and checks.

- **RED** - The 9V POWER leads. Both leads are connected to the 9 volt battery inside the tester whenever the POWER switch is in the ON or 9V BATT. CHECK position. Ignition modules and some sensors require this power for testing.
- **YELLOW** - The SIGNAL lead. Signals probed by this lead cause the TEST lights to react. Usually connected to a sensor or ignition module output circuit during testing.
- **BLACK** - The COMMON lead. Used as a circuit ground or signal reference point for all tests and checks. This lead is always used.

⑤ Jumper Lead

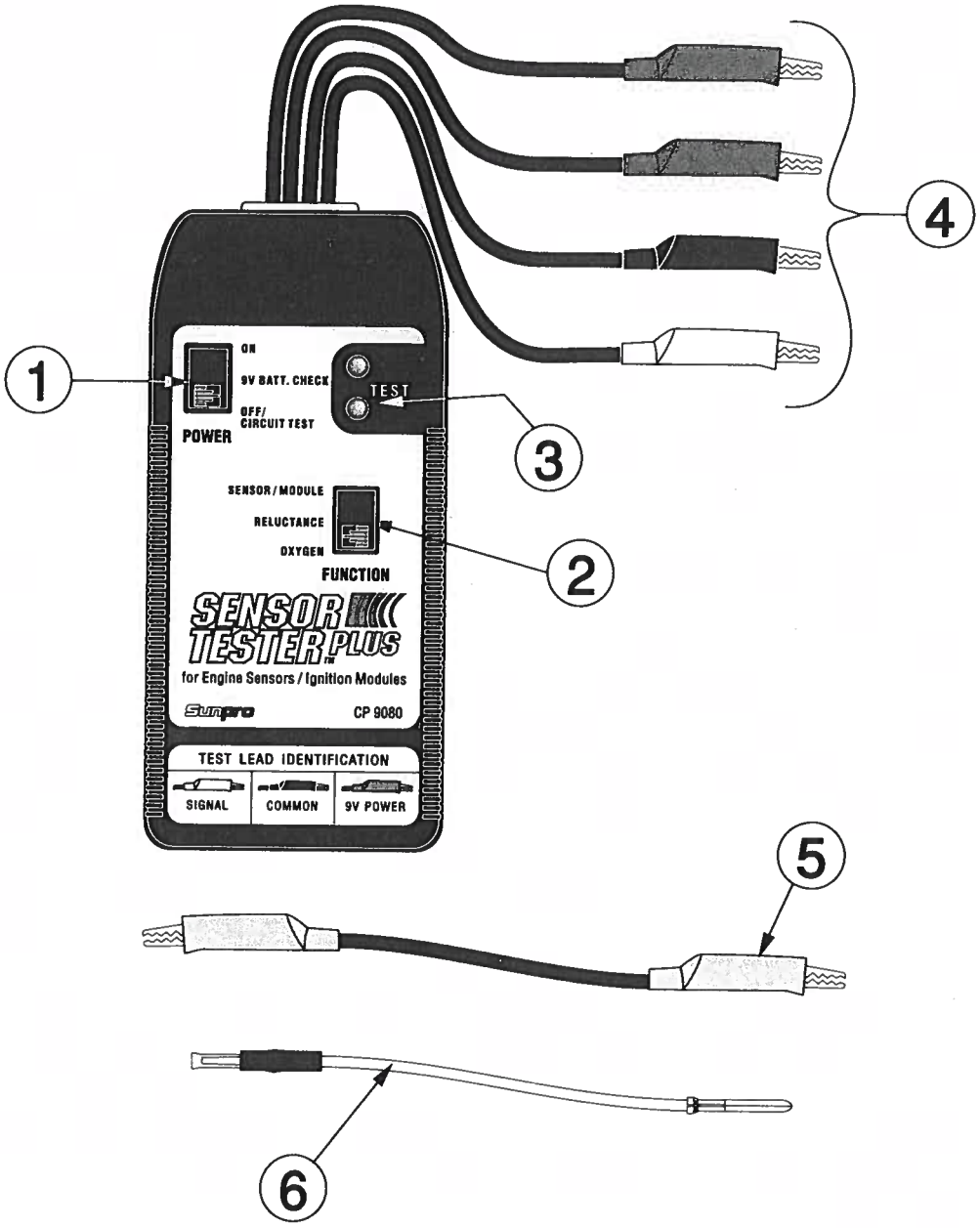
Used when checking some ignition modules. Makes extra connections as required for testing.

⑥ Connector Pin Adapters

Used for easier attachment of test leads to certain sensor or module connector pins.

- Push one end of the adapter onto the desired connector pin.
- Grasp the other end with the test lead clip.

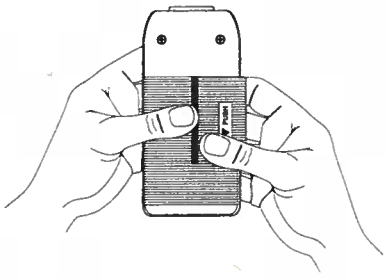
NOTE: The male and female pins are of different sizes. The adapters can NOT be used as "extender" leads.

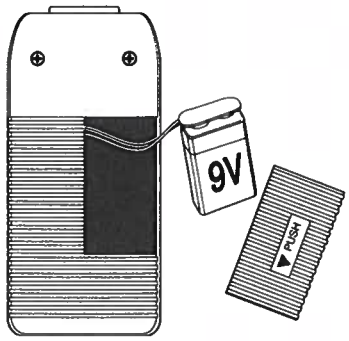


Sensor Tester Plus Power

A 9 volt transistor radio battery (NEDA 1604) is required to power the unit. Use an alkaline battery. (Conventional batteries are too weak for ignition module or dc idle speed control motor testing.) The battery must be installed before use.

Installing the Battery





Do the following:

1) Hold the tester face down with both hands as shown.

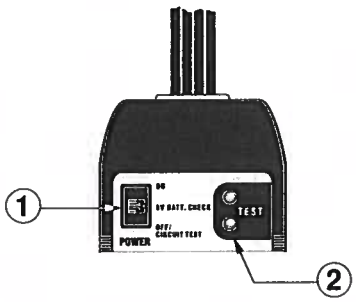
2) Using both thumbs, firmly push downwards and outwards on the battery compartment door at the center of the tester. (*Not* on the word "PUSH.")

3) Slide the battery compartment door sideways to remove.

4) Attach battery to connector and install inside compartment.

5) Replace battery door. Slide door sideways until it snaps closed.

Checking the Battery



Do the following:

Make sure the RED test leads are not touching the BLACK lead.

1) Slide the POWER switch to the 9V BATT. CHECK position. (FUNCTION switch may be in any position.)

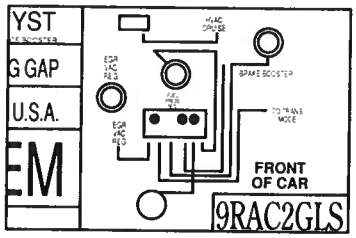
2) Look at the lower TEST light. A bright or medium bright light means the battery is O.K. for use. Replace battery if lower test light is very dim, or off.

Section 3 Testing Sensors

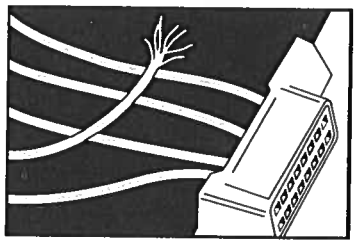
Troubleshooting Tips

Do a thorough visual and "hands-on" underhood inspection before starting any diagnostic procedure! You can find the cause of many problems by just looking, thereby saving yourself a lot of time.

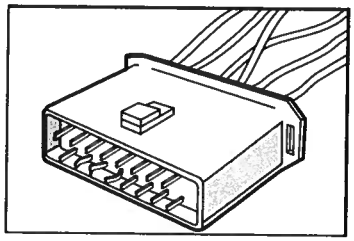
- Has the vehicle been serviced recently? Sometimes things get reconnected in the wrong place, or not at all.
- Don't take shortcuts. Inspect hoses and wiring which may be difficult to see due to location.
- Inspect the air cleaner and ductwork for defects.
- Check sensors and actuators for damage.



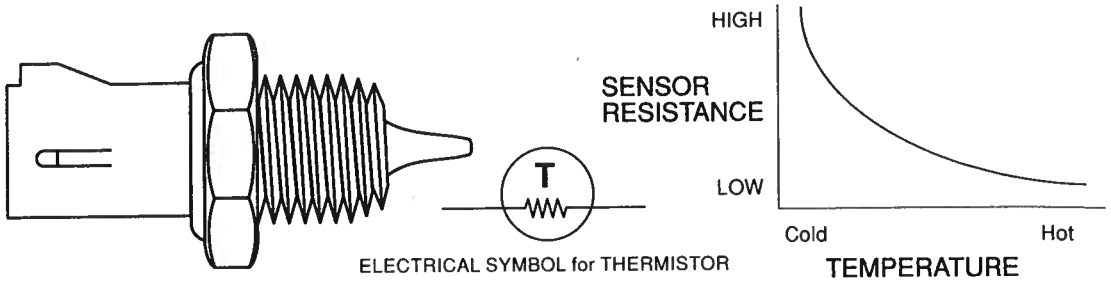
- Inspect all vacuum hoses for:
  - — Correct routing. Refer to vehicle service manual, or Vehicle Emission Control Information(VECI) decal located in the engine compartment.
  - — Pinches and kinks.
  - — Splits, cuts or breaks.



- Inspect wiring for:
  - — Contact with sharp edges.
  - — Contact with hot surfaces, such as exhaust manifolds.
  - — Pinched, burned or chafed insulation.
  - — Proper routing and connections.



- Check electrical connectors for:
  - — Corrosion on pins.
  - — Bent or damaged pins.
  - — Contacts not properly seated in housing.
  - — Bad wire crimps to terminals.



Typical Engine Coolant Temperature Sensor

Referred to as Coolant Temperature sensor, Engine Coolant Temperature sensor or similar names

What is It?

The engine temperature sensor is a thermistor – a resistor whose resistance changes with temperature. The hotter the sensor gets, the lower the resistance becomes. The thermistor is mounted inside the tip of a threaded metal housing. This is a 2-wire sensor. (Exception: some Chrysler engines have a dual sensor with 3 wires.)

How is it Used?

The computer needs to know engine temperature so it can modify air/fuel ratio, spark advance, idle speed and emission device operation (such as EGR valve).

Location

The sensor is threaded into the engine block to give it direct contact with the engine coolant.

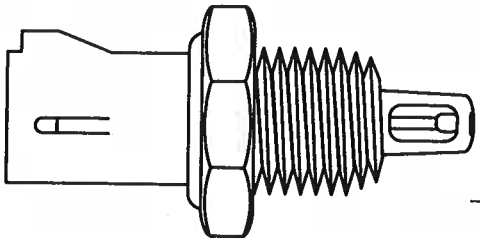
When to Check

Related trouble codes sent by computer. Driveability problems such as hard starting, stalling, rough idle, hesitation, stumble, surging, knocking (pinging), poor fuel economy or black exhaust smoke.

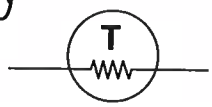
What to Inspect

Sensor operation (see page 3-4). Poor connections at the sensor or computer. Sensor housing can leak or become heavily coated with cooling system sludge causing poor response. Engine cooling system problems (antifreeze, thermostat, water pump, fan, belts). Low engine oil level.

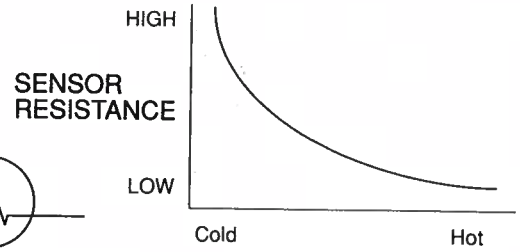
Inlet Air TEMPERATURE



Typical Air Temperature Sensor



ELECTRICAL SYMBOL for THERMISTOR



Referred to as Manifold Air Temperature sensor, Air Charge Temperature sensor or similar names

What is It?

The inlet air temperature sensor is a thermistor - a resistor whose resistance changes with temperature. The hotter the sensor gets, the lower the resistance becomes. The thermistor is mounted in the tip of a threaded metal housing. This is a 2-wire sensor.

How is it Used?

The computer needs to know air temperature to calculate the amount of air entering the engine. Then, the computer can provide the proper air/fuel mixture for the desired operating condition.

Location

The sensor is threaded into the intake manifold, throttle body or elsewhere along the path of air entering the engine

When to Check

Related trouble codes sent by computer. Driveability problems such as hard starting, stalling, rough idle, hesitation, stumble, surging, poor fuel economy or black exhaust smoke.

What to Inspect

Sensor operation (see page 3-4). Poor connections at the sensor or computer. Sensor tip heavily coated with carbon, soot or other contaminants in the incoming air stream causing poor response. Blocked or restricted air passageways. Engine cooling system problems (antifreeze, thermostat, water pump, fan, belts). Low engine oil level.

TEST PROCEDURES

Use these procedures for all engine coolant or incoming air temperature sensors.

IMPORTANT: Always check Tester battery (Sec. 2).

Set-Up

1) Set POWER switch to OFF. Set FUNCTION switch to SENSOR/MODULE.
2) Disconnect wire harness from sensor. Inspect for damage.
3) Connect YELLOW test lead to either sensor pin.
4) Connect BLACK test lead to remaining sensor pin.
5) Make sure metal clips make good contact and do not touch each other.

On-Car Test

Warning: Involves running engine. Observe all safety precautions (see page iv). Work in well ventilated area.

1) Verify **Set-Up**. Engine/sensor must be cool.
2) Set POWER switch to ON. Note TEST light appearance.
3) Start engine. Idle at 2000 RPM for 2 minutes to warm-up sensor.

Note: *Disconnected sensor may cause starting difficulty. Crank with partial throttle opening, or reconnect sensor to engine wiring. Most computer systems will store a trouble code in memory (and turn on the "Check Engine" light) if engine is run with sensor disconnected. Ignore or erase the code after testing. Refer to Vehicle Service Manual.*

4) Re-do **Set-Up** if Sensor Tester Plus removed during Step 3. Note TEST light appearance. Refer to **TEST RESULTS.**

Off-Car Test

1) Verify **Set-Up**. Sensor must be cool (room temperature).
2) Set POWER switch to ON. Note TEST light appearance.
3) Heat sensor tip until too hot to touch. Keep hot at least 20 seconds.
   - Dip sensor tip into boiling water, or...
   - Heat tip with flame from candle or cigarette lighter.
4) Note TEST light appearance. Refer to **TEST RESULTS.**

TEST RESULTS

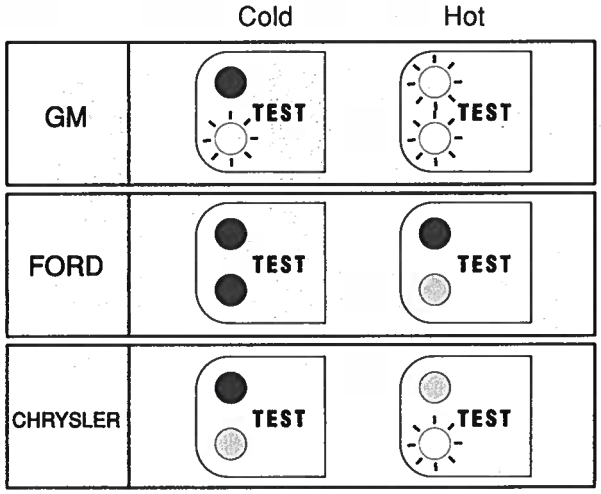
Good Sensor

TEST lights (upper, lower or both) will increase in brightness as the sensor warms up. Charts below show typical results. Actual performance may vary due to test conditions.

Bad Sensor

- Both TEST lights are always OFF or brightly ON or...
- No change in brightness occurs during warm-up.

= Bright
= Dim
= Off

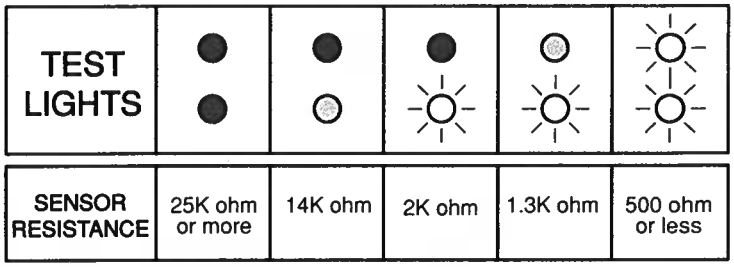


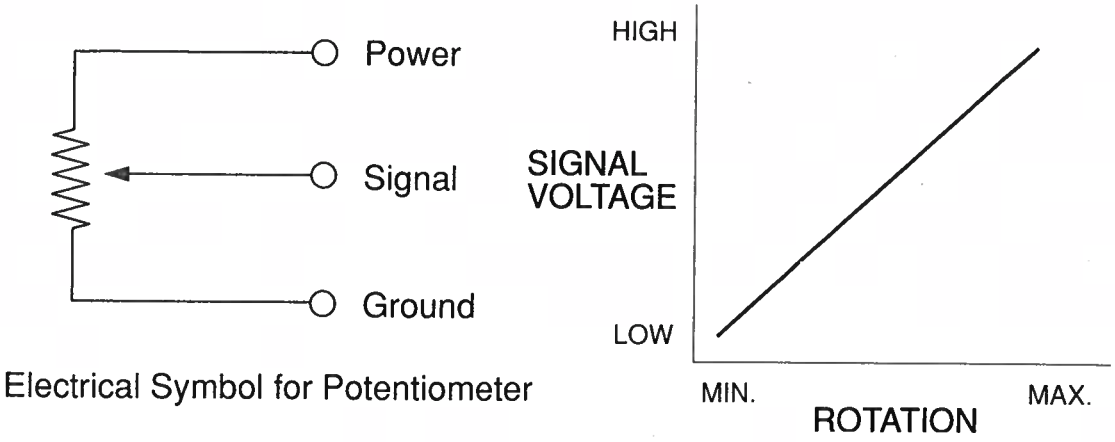
Other

Many other temperature sensors will behave like one of the above charts. Consult Vehicle Service Manual to find sensor resistance values at cold and hot temperatures. For an accurate test:

- Cold resistance must be above 2K ohms or...
- Hot resistance must be less than 10K ohms.

The chart below shows how the TEST lights respond to various resistance values.





Electrical Symbol for Potentiometer

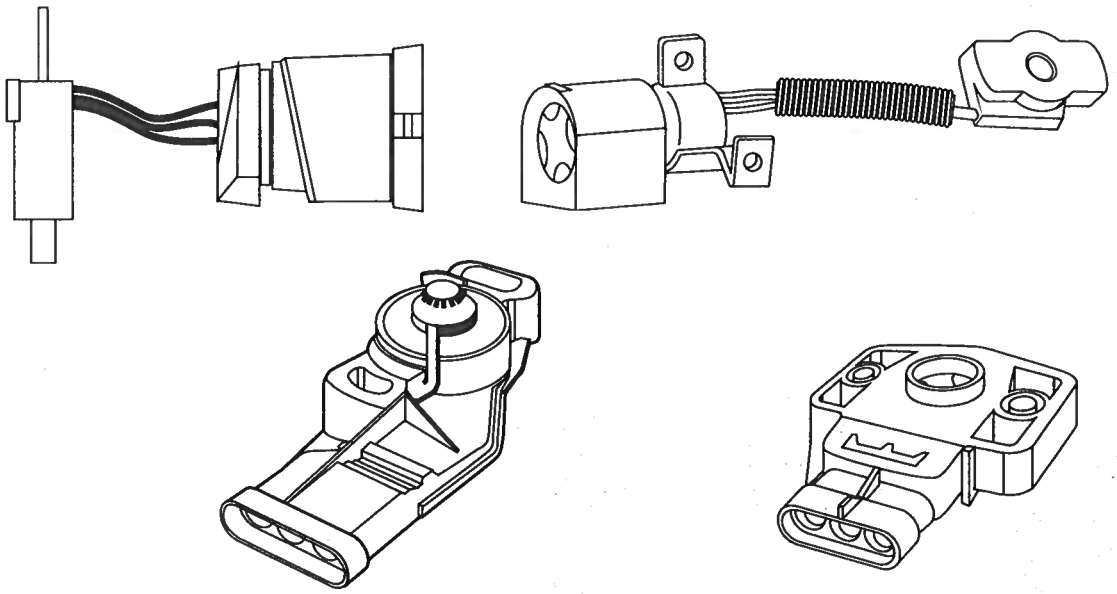
What is It?

The throttle position sensor is a potentiometer – a type of variable resistor (similar to a dashboard light dimmer control). These sensors come in a wide variety of styles - some with connectors at the end of a short wire "pigtail." The computer supplies power and ground to the sensor. The sensor has an element which is turned (rotary type) or pushed (linear type). When the sensor is mounted on the engine, the element is linked to the throttle so they move together. The sensor sends out a voltage signal indicating element (and thus throttle) position. The voltage signal gets larger the more the element is moved.

How is it Used?

The computer uses throttle position to determine the engine operating condition: idle (closed throttle), cruise (part throttle) or hard acceleration (wide open throttle). Then, the computer can properly control air/fuel mixture, spark advance, idle speed and lock-up torque converter.

THROTTLE POSITION



TYPICAL THROTTLE POSITION SENSORS

Location

Rotary type: Mostly used on fuel injected engines. Mounted to outside of throttle body – linked to throttle shaft.

Linear (sliding) type: Mostly used on carburetored engines. Mounted inside the carburetor (typical GM) or outside the carburetor (some Ford).

When to Check

Related trouble codes sent by computer. Driveability problems such as hard starting, stalling, rough idle, erratic idle, hesitation, stumble, surging, poor fuel economy, knocking (pinging), backfiring, no torque converter "lock-up."

What to Inspect

Sensor operation (see page 3-8). Poor connections at the sensor or computer. Binding throttle shaft or linkage. If used: "Cruise Control" linkage problems, idle speed control motor, other mechanical idle speed, choke, or cam systems affecting throttle position.

TEST PROCEDURE SET-UP

Use this procedure for most GM, Ford and Chrysler throttle position sensors. For other types, consult Vehicle Service Manual for location of sensor signal output pin (referred to in step 3).

Set-Up

1) Set POWER switch to OFF.

   Set FUNCTION switch to SENSOR/MODULE.

2) Disconnect vehicle wire harness from sensor. Inspect for damage.

3) Connect YELLOW test lead to sensor SIGNAL pin.

   • Middle pin on In-Line connector or...

   • Connector pin attached to middle wire coming out of sensor.

4) Connect BLACK test lead to <u>either</u> remaining sensor pin.

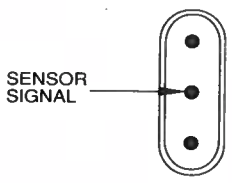
5) Connect RED test lead (either one) to last remaining sensor pin.

6) Make sure metal clips make good contact and do not touch each other.

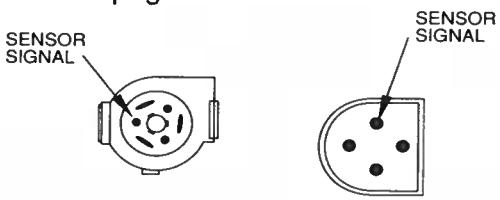
7) Set POWER switch to ON. If both TEST lights are brightly ON, reverse the RED and BLACK test lead connections. (Attach the BLACK clip where the RED clip used to be and attach the RED clip where the BLACK clip used to be.) Recheck all connections - make sure metal clips do not touch each other. If the TEST lights are still brightly ON, the sensor is defective.

8) At this point, the <u>upper</u> TEST light should be OFF. The <u>lower</u> TEST light may be OFF or ON.

9) Continue Test Procedure on next page.



TYPICAL
INLINE SENSOR
CONNECTOR



FORD "PIG TAIL"
SENSOR CONNECTORS

TEST PROCEDURE

IMPORTANT: Always check Tester battery (Sec. 2).

Warning: Observe all safety precautions (see page iv) if testing sensor on vehicle.

1) Verify **Set-Up**.
2) Upper TEST light should be OFF.

   Lower TEST light should be OFF or ON.
3) Carefully observe TEST lights while performing this step.

   On-Car: Ignition key OFF. Slowly move throttle linkage from closed to wide open position.

   Off-Car: Slowly rotate (or push) sensor element from minimum to maximum position.

Good Sensor

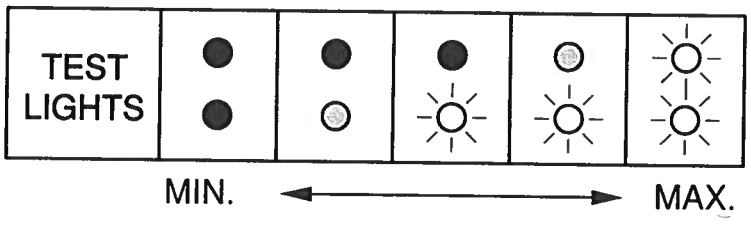
- Lower TEST light increases in brightness until fully ON (upper TEST light remains off), then...
- Upper TEST light turns ON and gradually increase in brightness (lower TEST light remains on).
- Refer to chart below for typical test results.

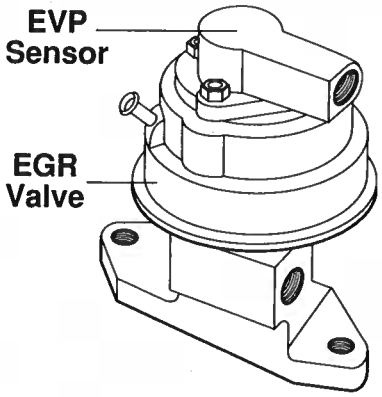
Bad Sensor

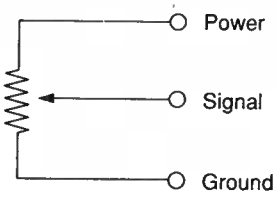
- TEST light (either one) flickers or blinks OFF during movement of throttle sensor, or...
- TEST lights do not change brightness during movement of throttle sensor.

☼ = Bright
○ = Dim
● = Off

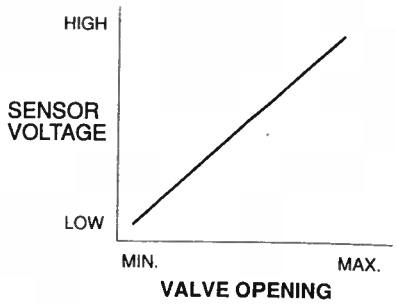
4) Repeat Step 3 a few times to verify results.
5) Testing is complete. Set POWER switch to OFF and remove all test leads.







Electrical symbol for potentiometer



What is It?

The EGR Valve Position (EVP) sensor is a potentiometer – a type of variable resistor (similar to a dashboard light dimmer control). The computer supplies power and ground to the sensor. The sensor has a shaft which is pushed. When the sensor is mounted on the EGR valve, the shaft gets pushed as the valve opens. The sensor sends out a voltage signal indicating the amount of valve opening. The voltage signal gets larger the more the EGR valve is opened.

How is it Used?

The computer is programmed to provide an optimum amount of EGR flow during idle, cruise and hard acceleration operating conditions. The computer uses the sensor signal to calculate actual EGR flow. Then the computer can modify the EGR valve opening as required.

Location

The sensor is bolted to the top of the EGR valve.

When to Check

Related trouble codes sent by computer. Driveability problems such as hesitation, stumble, surging, poor fuel economy, erratic acceleration, knocking (pinging), no torque converter "lock-up."

What to Inspect

Sensor operation (see next page). Poor connections at the sensor or computer. Damaged or sticking EGR valve. Worn or broken vacuum lines, vacuum connectors. Damaged vacuum reservoir, cannister. Problems with control solenoids supplying operating vacuum to open EGR valve.

TEST PROCEDURE

IMPORTANT: Always check Tester battery (Sec. 2).

Warning: Observe all safety precautions (see page iv) if testing sensor on vehicle.

1) Set POWER switch to OFF. Set FUNCTION switch to SENSOR/MODULE.
2) Disconnect vehicle wire harness from sensor. Inspect for damage.
3) Connect YELLOW, BLACK and RED (either one) test leads to sensor connector as shown.
4) Make sure metal clips make good contact and do not touch each other.
5) Set POWER switch to ON. Upper TEST light should be OFF. Lower light should be off or dim. If the TEST lights are brightly ON, the sensor is defective.
6) Carefully observe TEST lights while performing this step.

   On-Car: Ignition key OFF. Connect hand vacuum pump to EGR valve. Gradually apply vacuum to slowly open valve.

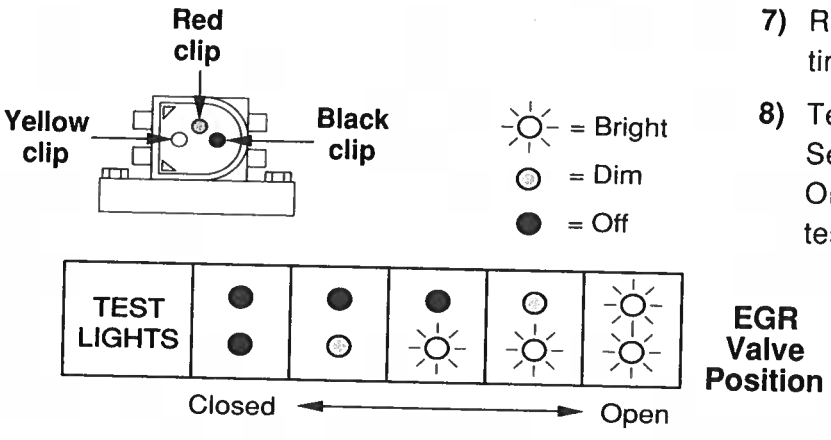
   Off-Car: Slowly push sensor element from minimum to maximum position.

Good Sensor

- Lower TEST light increases in brightness until fully ON (upper TEST light remains off), then...
- Upper TEST light turns ON and gradually increase in brightness (lower TEST light remains on).

Bad Sensor

- TEST light (either one) flickers or blinks OFF during movement of sensor shaft, or...
- TEST lights do not change brightness during movement of sensor shaft.



7) Repeat Step 6 a few times to verify results.
8) Testing is complete. Set POWER switch to OFF and remove all test leads.

Referred to as O2 sensor, Oxygen sensor, Exhaust Gas Oxygen sensor, Heated Oxygen sensor, Heated Exhaust Gas Oxygen sensor or similar names.

Typical Oxygen Sensor

What is It?

The oxygen sensor is a zirconium dioxide ceramic mounted in the tip if a threaded metal housing. The tip is perforated to protect the sensing element but still allow exhaust gases to pass through.

The sensor produces a voltage signal based on the amount of oxygen it contacts. A low voltage indicates a lean exhaust (too much oxygen). A higher voltage signals a rich exhaust (not enough oxygen).

The sensor must be very hot to operate: 660°F (349°C). Some have 2-wire heating elements built-in to quicken the warm-up time.

How is it Used?

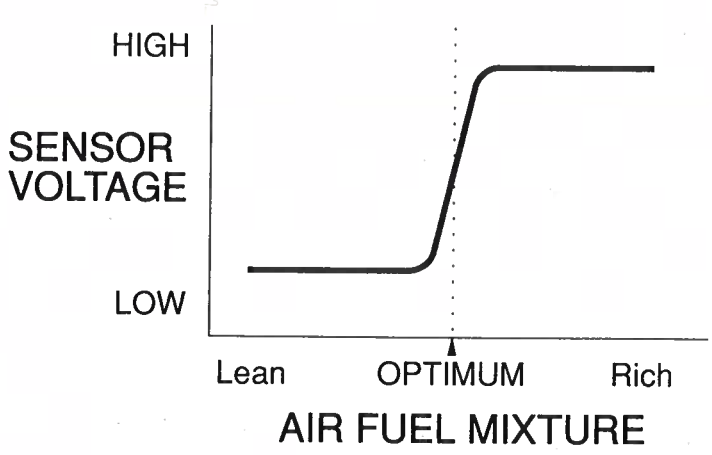
The computer uses this sensor to deliver an optimum air/fuel mixture to the engine - for low emissions and good fuel economy. If the sensor indicates a rich exhaust (not enough oxygen because too much fuel) the computer will compensate by reducing fuel delivery. If the computer receives a lean signal (too much oxygen because not enough fuel) it will increase fuel delivery. Some systems use use more than one sensor.

Location

The sensor is threaded into the exhaust manifold to give it direct contact with the exhaust gases.

Rich = 0.6 to 1.1 volts

Lean = 0.4 volts or less



When to Check

Related trouble codes sent by computer. Driveability problems such as rough running, hesitation, stumble, poor fuel economy, poor performance or black exhaust smoke.

What to Inspect

Sensor operation (see page 3-14). Poor connections at the sensor or computer.

This sensor often fails because of contamination from fuel, oil additives, gasket sealer or overly rich running engine. Factors which can make a rich running engine include: ignition system problems (coil, distributor cap, rotor, spark plugs, wires), fuel contaminated engine oil, emission devices (carbon cannister, EGR valve, PCV valve, air injection system), manifold leaks, air filter, fuel pressure and engine not at normal operating temperature.

IMPORTANT: ***Some engines (mostly in off-road vehicles) use a titania type oxygen sensor. This sensor resembles the common zirconium type, but has an open-ended tip. The titania sensor changes resistance when it operates. The Sensor Tester Plus is not designed to test the titania type sensor.***

TEST PROCEDURES

IMPORTANT: Always check Tester battery (Sec. 2).

Sensor Types

1-Wire: Single wire goes to sensor SIGNAL. Sensor housing is connected to sensor GROUND.

2-Wire: One wire goes to sensor SIGNAL. Second wire goes to sensor GROUND. Refer to Vehicle Service Manual for wire identification. (Signal wire is often black.)

3-Wire: Two wires (same color) go to the sensor heating element. Third wire (different color from the others) goes to sensor SIGNAL. Sensor housing is connected to sensor GROUND.

4-Wire: Two wires (same color) go to the sensor heating element. Third wire goes to sensor SIGNAL. Fourth wire goes to sensor GROUND. Refer to Vehicle Service Manual for wire identification. (Signal wire is often black.)

On-Car Test

Important: Reliable testing of the oxygen sensor while on-vehicle is very difficult because test conditions cannot be well controlled. If the sensor responds during this test, than it is probably good and no other testing is necessary. If the sensor does not seem to respond during this test, remove it and perform the Off-Car test before deciding whether or not the sensor is bad.

Warning: Involves running engine. Observe all safety precautions (see page iv). Work in well ventilated area.

1) Set POWER switch to OFF.
   Set FUNCTION switch to OXYGEN.
2) Disconnect wire harness from sensor. Inspect for damage.

TEST PROCEDURES (cont.)

3) Connect YELLOW test lead to sensor SIGNAL pin. (See "Sensor Types".)

4) Connect BLACK test lead to sensor GROUND.

5) Make sure metal clips make good contact and do not touch each other.

6) Set POWER switch to ON. Both TEST lights should be OFF. If the lights are on, the sensor is defective.

7) Start engine. Idle at 2000 RPM for 2 minutes to warm-up sensor.

Note: Most computer systems will store a trouble code in memory (and turn on the "Check Engine" light) if engine is run with sensor disconnected. Ignore or erase the code after testing. Refer to Vehicle Service Manual.

8) Observe TEST lights while performing this step.

• Maintain throttle partially open (2000 RPM idle).

IF both TEST lights turn ON steadily, or...

IF both TEST lights start flashing ON and OFF...

THEN the sensor is good and no further testing is necessary.

9) Try this step if the TEST lights did not turn on during Step 8.

• Maintain throttle partially open (2000 RPM idle), then...

• Quickly release throttle completely.

IF both TEST lights momentarily flash ON and then go back off...

THEN the sensor is good and no further testing is necessary.

(You can repeat this step a few times to verify results.)

10) If the TEST lights did not turn on during Steps 8 or 9, remove the sensor and perform the Off-Car test.

TEST PROCEDURES (cont.)

NOTE: Some Vehicle Service Manuals may have a recommended on-car test procedure for the oxygen sensor. Often a voltmeter is connected to monitor the sensor signal. You can follow that procedure using the Sensor Tester Plus. Do the following:

- Set POWER switch to ON.
- Set FUNCTION switch to OXYGEN.
- Use the YELLOW test lead in place of the voltmeter "+" lead.
- Use the BLACK test lead in place of the voltmeter "-" or common lead.
- The TEST lights go ON when signal voltage is above 0.5 volts (rich indication).
- The TEST lights go OFF when signal voltage is below 0.5 volts (lean indication).

Off-Car Test

Warning: Involves use of an open flame from a propane torch. Observe all safety precautions for torch operation. Do not use near flammable material or gases.

1) Set POWER switch to OFF.

   Set FUNCTION switch to OXYGEN.
2) Firmly grasp sensor with a pair of locking pliers.
3) Connect YELLOW test lead to sensor SIGNAL pin. (See "Sensor Types".)
4) Connect BLACK test lead to sensor GROUND.
5) Make sure metal clips make good contact and do not touch each other.

TEST PROCEDURES (cont.)

6) Set POWER switch to ON. Both TEST lights should be OFF. If the lights are on, the sensor is defective.

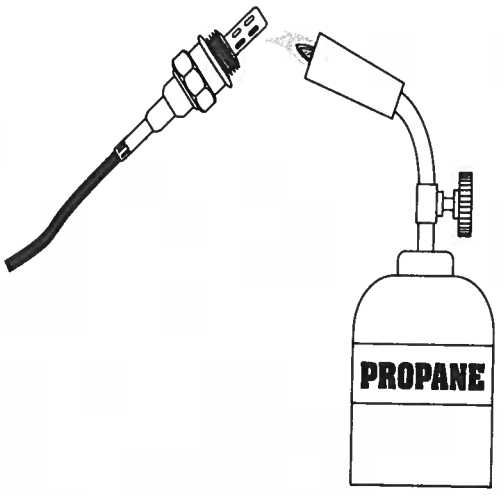
7) Light torch. Thoroughly heat sensor tip until tip is as hot as possible, but not "glowing." The sensor tip must be *very* hot to operate! (660°F, 349°C)

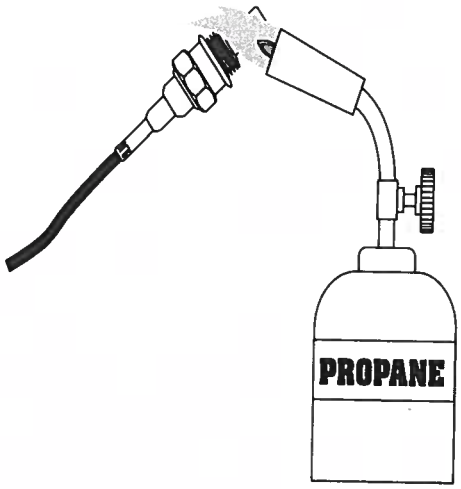
8) After sensor tip is hot, move the flame until the sensor tip is completely surrounded by the flame. This keeps oxygen away from the tip. Both TEST lights should turn ON indicating a "rich" (low oxygen) condition at the sensor tip. If this does not happen, the sensor is defective. The TEST lights should go OFF within 3 seconds after the flame is removed. If it takes longer than 3 seconds for the TEST lights to go off, the sensor is defective.

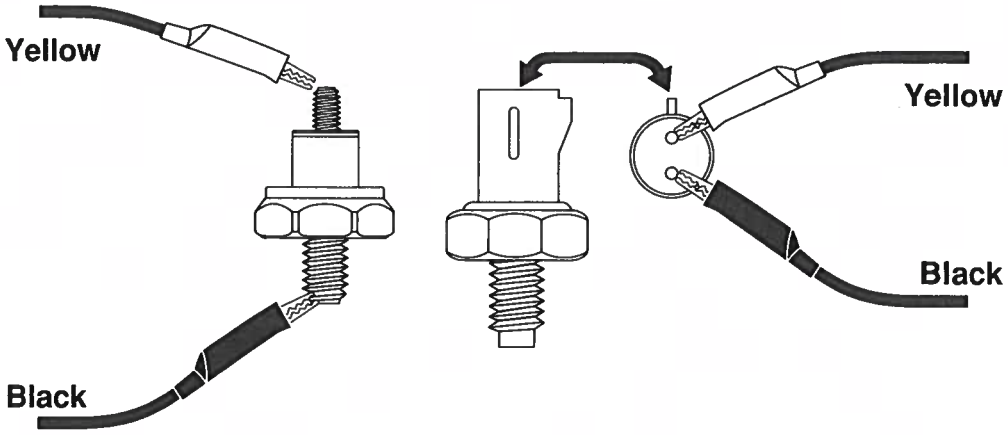
9) Repeat Step 8 a few times to verify results.

10) Testing is complete. Extinguish flame, let sensor cool and remove test leads.

IMPORTANT: Special anti-seize compound must be applied to sensor housing threads before reinstallation. Refer to Vehicle Service Manual for proper type.







Referred to as Knock Sensor or Detonation Sensor.

What is It?

The knock sensor is a piece of piezoelectric material mounted in a threaded metal housing. The sensor acts like a microphone – it changes vibrations into a small AC voltage signal. The sensor can have a one wire (GM and Chrysler) or two wire (Ford) connector.

How is it Used?

The computer (or other spark timing controller) is designed to recognize sensor signals caused by engine knock vibrations. Then, spark timing is retarded to eliminate the damaging knock condition.

Location

The sensor is threaded into the intake manifold, exhaust manifold or engine block.

When to Check

Related trouble codes sent by computer. Knocking during cruise or hard acceleration (not enough spark retard). Hesitation, poor performance and fuel economy (excess spark retard).

What to Inspect

Sensor operation (see next page). Poor connections at the sensor or computer. Open or short circuit wiring problems in sensor circuit. Spark timing. Bad fuel quality.

TEST PROCEDURE

IMPORTANT: Always check Tester battery (Sec. 2).

Warning: Observe all safety precautions (see page iv) if testing sensor on vehicle.

1) Set POWER switch to OFF. Set FUNCTION switch to RELUCTANCE.

2) Disconnect vehicle wire harness from sensor. Inspect for damage.

3) Connect YELLOW and BLACK test leads to sensor.

one-wire connector:
- YELLOW test lead to signal pin (top of sensor).
- BLACK test lead to body of sensor (off-car) or nearby ground (on-car).

two wire connector:
- YELLOW test lead to <u>either</u> sensor pin.
- BLACK test lead to remaining sensor pin.

4) Make sure metal clips make good contact and do not touch each other.

5) Set POWER switch to ON. <u>Both</u> TEST lights should be OFF. If both TEST lights are brightly ON, the sensor is defective.

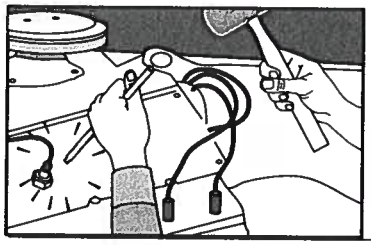
6) <u>Carefully observe TEST lights while performing this step</u>.

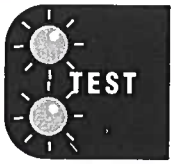
On-Car: Ignition key OFF. Tap mounting surface near sensor using a socket extension (or similar tool) and a light hammer. Do not tap sensor.

Off-Car: Firmly hold sensor. Gently tap sensor tip with a light hammer.

Good Sensor:
- Both TEST lights briefly blink ON every time the sensor is tapped.

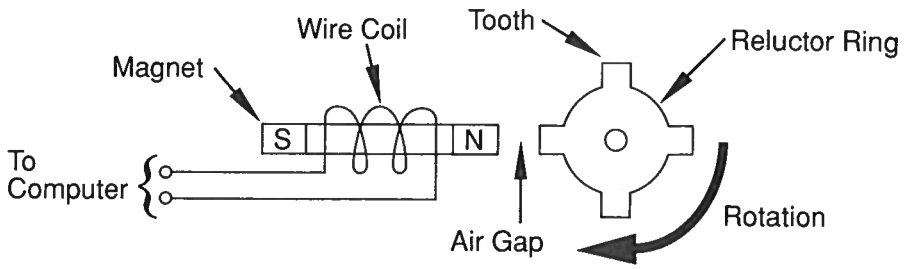
Bad Sensor:
- TEST lights do not blink on when the sensor is tapped.





7) Repeat Step 6 a few times to verify results.

8) Testing is complete. Set POWER switch to OFF



Reluctance Sensor Operation

What is It?

The reluctance sensor is a 2-wire type. It consists of a permanent magnet with a coil of wire wrapped around it. Nearby the sensor is a toothed ring made of iron or steel (sometimes called a "reluctor"). The ring is attached to a rotating component such as the crankshaft or camshaft. Whenever a tooth from the ring passes by the sensor, it attracts the magnetic field lines surrounding the magnet. As the field lines move, they pass through the wire coil and generate a small voltage pulse (magnetic induction principle). Thus, a voltage pulse is generated every time a tooth passes by the sensor coil.

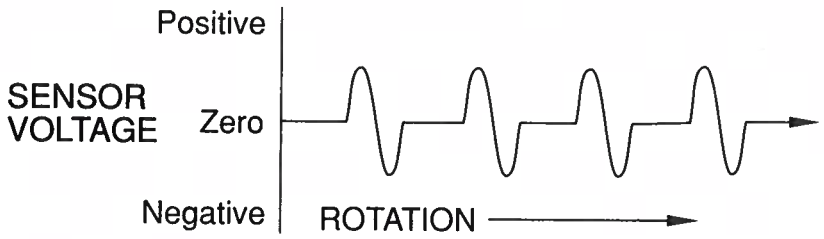
The computer determines speed of rotation by measuring how fast pulses appear. Note: The voltage pulses get larger when the teeth pass by more quickly. Values can range from a fraction of a volt (crank RPM) to over a hundred volts (high RPM).

How is it Used and Where is it Located?

Reluctance sensors are used whenever the computer needs to know speed and position of a rotating object. For example...

Camshaft: The sensor is located inside the distributor (If the engine has one). Sensor commonly called a "distributor pick-up" in this application. Vehicles without a distributor have the sensor located in various places around the engine where it can be mechanically linked to the camshaft. Sends camshaft speed and position information to computer for spark timing or fuel injector control.

Crankshaft: Sensor located in various places around the engine where it can be mechanically linked to the crankshaft. This gives the computer timing information required



Typical Sensor Signal Voltage

for spark control (distributorless ignition systems) or fuel injector operation (port fuel injection systems).

Driveshaft: Sensor located in transmission housing or near driveshaft. Computer calculates vehicle speed from driveshaft RPM information. Uses include control of torque convertor lock-up, engine cooling fan, variable assist power steering and "cruise control." If vehicle has an electronically controlled transmission, the computer uses both driveshaft RPM and crankshaft RPM sensor signals to control shift points and torque converter slippage.

Wheel Speed: Sensors send wheel speed information to anti-lock brake (ABS) or traction control computer. Toothed rings may be on individual wheels, drive shaft or transmission shaft.

When to Check

Related trouble codes sent by computer. No start, stalling, rough running (ignition or port fuel injection system). No torque converter "lock-up" (transmission). Faulty, slipping or no gear shifting (electronic transmission). ABS braking system faulty or not working.

What to Inspect

Sensor operation (see next page). Poor connections at the sensor or computer. Open or short circuits in sensor coil or vehicle wiring harness. Too much gap between sensor coil and reluctor ring. Cracked, broken or missing teeth on reluctor ring. Note: Some rings may normally have a gap or irregular tooth space. This gives the computer timing information required for spark control (distributorless ignition systems) or fuel injector operation (port fuel injection systems).

TEST PROCEDURE

(for all types of reluctance sensors)

IMPORTANT: Always check Tester battery (Sec. 2).

Set-Up:

IMPORTANT: Reluctance sensors come in many styles using different connectors. Refer to Vehicle Service Manual for connector location and identification of the two sensor coil pins. (Connector may have additional pins - these are not used for testing.)

Sensor may be checked on-car if:

- Tester can be reliably connected to sensor and...
- Sensor can be safely activated - by cranking engine (camshaft, crankshaft sensor) or spinning vehicle wheel (wheel sensor).

Do not test vehicle speed type sensors since they require vehicle motion.

Off-car testing is limited to sensors and reluctor rings which can be removed together as an assembly - such as in a distributor. (Sometimes the whole distributor must be removed.)

1) Set POWER switch to OFF.

Set FUNCTION switch to RELUCTANCE.

2) Disconnect wire harness from sensor connector. Inspect for damage.

3) Connect YELLOW test lead to <u>either</u> sensor coil pin.

4) Connect BLACK test lead to remaining sensor coil pin.

5) Make sure metal clips make good contact and do not touch each other.

Test:

Warning: Observe all safety precautions when working on a vehicle (see page iv).

1) Verify **Set-Up**.

2) Set POWER switch to ON. Both TEST lights should be OFF. If the lights are both on, the sensor is defective.

3) Rotate reluctor ring to activate sensor signal...

Off-car:

- Rotate ring manually. Give it a quick spin in either direction.

On-car (camshaft, crankshaft sensor):

- Crank engine. STAY AWAY from moving engine parts. Observe all safety precautions (see page iv) - engine may start or backfire.

Note: Some computer systems will store a trouble code in memory (and turn on the "Check Engine" light) if engine is cranked with sensor disconnected. Ignore or erase the code after testing. Refer to Vehicle Service Manual.

On-car (wheel sensor):

- Raise wheel off ground. Use jack stands and observe all safety precautions (see page iv).
- Give the wheel a quick spin in either direction.

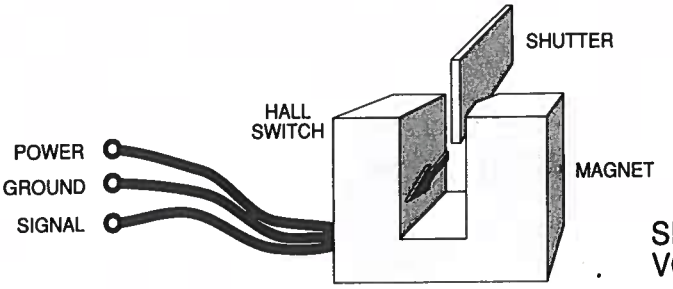
Good Sensor:

Both TEST lights flash ON and OFF, or stay ON continuously while the reluctor ring is rotating. (TEST lights go off when the ring stops.)

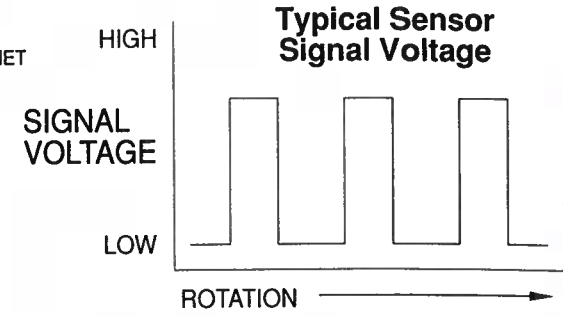
Bad Sensor:

Both TEST lights remain OFF while the reluctor ring is rotating.

4) Testing is complete. Set POWER switch to OFF and remove all test leads.



Typical Hall Effect Sensor



What is It?

The Hall effect sensor is a 3-wire type. Two wires supply power and ground. The third wire carries the sensor signal back to the computer. The sensor consists of a permanent magnet and a small module containing a transistorized Hall effect switch. A small air gap separates the sensor and magnet. The magnet field causes the Hall switch to turn on and send out a low voltage signal. If a metal strip (iron or steel) is placed in the gap, it will block the magnetic field from reaching the Hall device. This causes the Hall switch to turn off and send a high voltage signal out on the signal wire.

The metal strips (blades) are part of a disk or cup attached to a rotating component such as the crankshaft or camshaft. As the blades pass through the sensor gap, the signal voltage will switch high and low creating a series of pulses.

The computer determines speed of rotation by measuring how fast pulses appear.

How is it Used and Where is it Located?

Hall effect sensors are used whenever the computer needs to know speed and position of a rotating object. For example...

Camshaft: The sensor is located inside the distributor (If the engine has one). Sensor commonly called a "distributor reference" in this application. Vehicles without a distributor have the sensor located in various places around the engine where it can be mechanically linked to the camshaft. Sends camshaft speed and position information to computer for spark timing or fuel injector control.

Crankshaft: Sensor located in various places around the engine where it can be mechanically linked to the crankshaft.

This gives the computer timing information required for spark control (distributorless ignition systems) or fuel injector operation (port fuel injection systems).

When to Check

Related trouble codes sent by computer. No start, stalling.

What to Inspect

Sensor operation (see next page). Poor connections at the sensor or computer. Open or short circuits in vehicle wiring harness. Foreign objects in gap between Hall sensor and shutter assembly. Cracked, broken or missing blades on shutter. Note: Some shutter assemblies may normally have an irregular blade space. This gives the computer timing information required for spark control (distributorless ignition systems) or fuel injector operation (port fuel injection systems).

TEST PROCEDURE

(for all types of Hall Effect sensors)

IMPORTANT: Always check Tester battery (Sec. 2).

Set-Up:

IMPORTANT: Hall effect sensors come in many styles using different connectors. Refer to Vehicle Service Manual for connector location and identification of sensor pins (Power, Ground and Signal).

Sensor may be checked on-car if:

- Tester can be reliably connected to sensor and...
- Sensor can be safely activated - for example, by cranking engine (camshaft, crankshaft sensor).

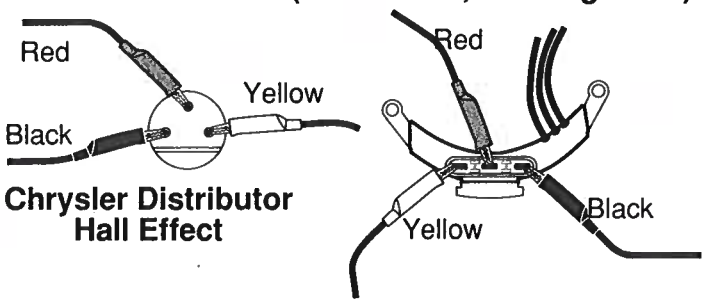
Otherwise, remove sensor from vehicle before testing.

1) Set POWER switch to OFF.
   Set FUNCTION switch to SENSOR/MODULE.
2) Disconnect wire harness from sensor connector.
   Inspect for damage.
3) Connect RED test lead to sensor POWER pin.

TEST PROCEDURE (cont.)

4) Connect YELLOW test lead to sensor SIGNAL pin.
5) Connect BLACK test lead to sensor GROUND pin.
6) Make sure metal clips make good contact and do not touch each other.

Ford Distributor Hall Effect (PIP Sensor, TFI-IV ignition)



Chrysler Distributor Hall Effect

Test:

Warning: Observe all safety precautions when working on a vehicle (see page iv).

1) Verify **Set-Up**.
2) Set POWER switch to ON.
3) Activate sensor signal...

Off-car:

• Slide a flat piece of iron or steel into the sensor slot – between the Hall switch and magnet. (Use a scrap piece of sheet metal, knife blade, steel ruler, etc.)

• Both TEST lights should be ON when the sensor slot is open, then turn OFF when the slot is blocked by a piece of metal. If this does not happen, the sensor is defective.

On-car (camshaft, crankshaft sensor):

• "Nudge" engine several times. (Momentarily turn ignition key to crank position, then quickly release.) STAY AWAY from moving engine parts. Observe all safety precautions (see page iv) - engine may start or backfire.

Note: Some computer systems will store a trouble code in memory (and turn on the "Check Engine" light) if engine is cranked with sensor disconnected. Ignore or erase the code after testing. Refer to Vehicle Service Manual.

• Both TEST lights should turn ON and OFF at various times as the engine is "nudged." If the lights never switch on or off after several "nudges" the sensor is probably defective. Remove sensor from vehicle and retest with off-car method to verify test results.

4) Testing is complete. Set POWER switch to OFF and remove all test leads.

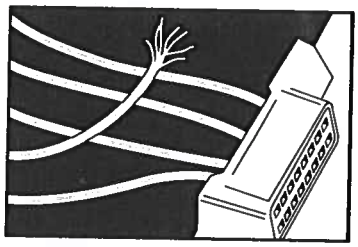
Section 4

Testing Ignition Modules

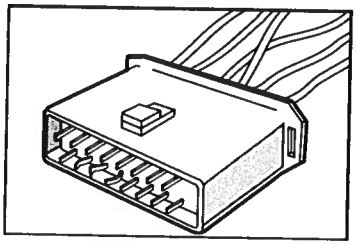
Troubleshooting Tips

Do a thorough visual and "hands-on" underhood inspection before starting any diagnostic procedure! You can find the cause of many problems by just looking, thereby saving yourself a lot of time.

- Has the vehicle been serviced recently? Sometimes things get reconnected in the wrong place, or not at all.
- Poor grounding can cause no-starts! Some modules make ground connections to vehicle chassis. Check mounting hardware, module flanges and chassis for clean contact surfaces and snug attachment.



- Inspect wiring for:
  - — Contact with sharp edges.
  - — Contact with hot surfaces, such as exhaust manifolds.
  - — Pinched, burned or chafed insulation.
  - — Proper routing and connections.

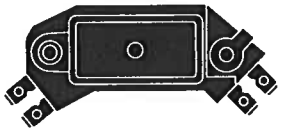


- Check electrical connectors for:
  - — Corrosion on pins.
  - — Bent or damaged pins.
  - — Contacts not properly seated in housing.
  - — Bad wire crimps to terminals.
- Check crankshaft/camshaft sensors connected to ignition module.
- Some ignition modules such as GM HEI and Ford TFI types require heat transfer compound applied between module and mounting surface. Modules can overheat and fail if compound is missing or incorrectly applied.

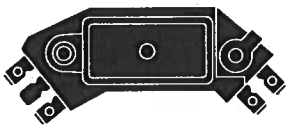
GM High Energy Ignition (HEI) System

Overview

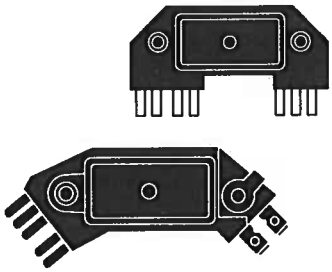
The HEI Ignition System was introduced in 1975 and used until DIS (Distributorless Ignition Systems) began to replace it in the mid '80's. This system replaces breaker points with a pick-up assembly (either magnetic reluctance or Hall effect type) and ignition module. There are several module types.



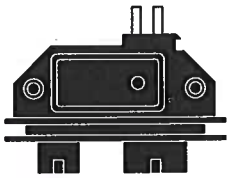
4-Pin Module: Basic function. Receives a signal from the pick-up inside the distributor and energizes the ignition coil to fire the spark plugs. Distributor has vacuum advance mechanism.



5-Pin Module: Same as 4-Pin module. Extra pin controlled by a vacuum switch or engine control computer. Used to retard timing by a fixed amount. Distributor has vacuum advance mechanism.



7-Pin Module: Used in systems where engine computer controls spark timing. Pick-up signal passes through module and goes to computer. Computer determines correct spark timing, then sends signal back to module to energize ignition coil. Distributor has no vacuum advance mechanism.



8-Pin Module: Same as 7-Pin Module, but different connector type. Extra pin used for circuit ground connection. Distributor has no vacuum advance mechanism.

Location

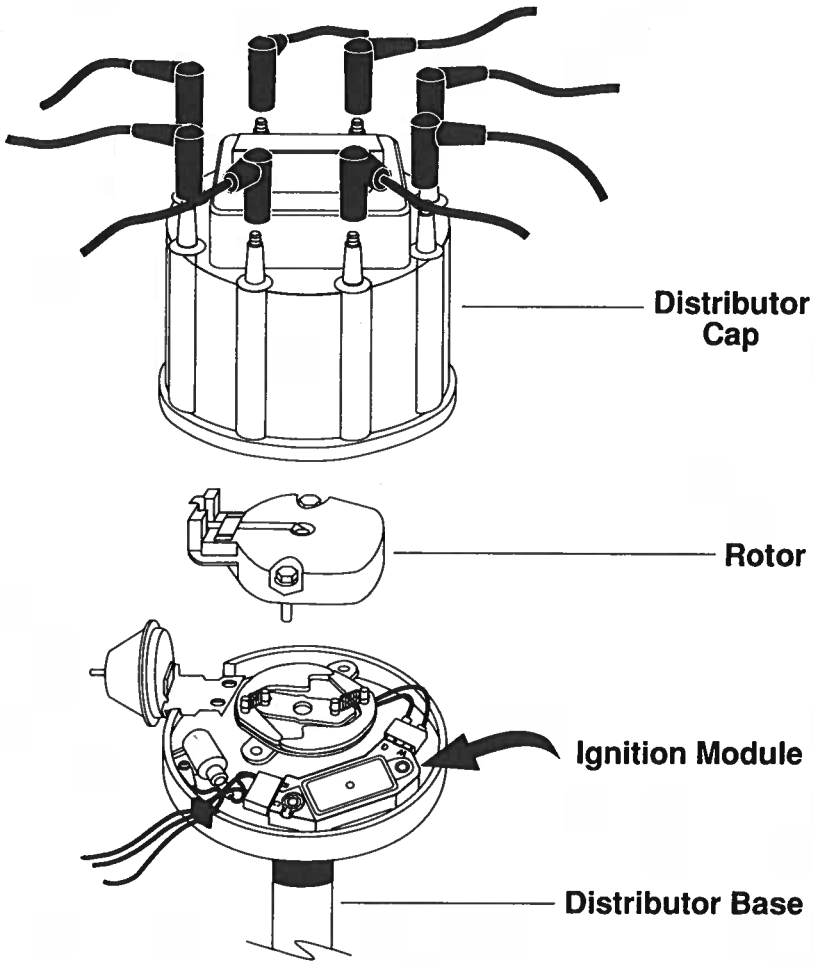
The ignition module is located inside the distributor.

Getting Started

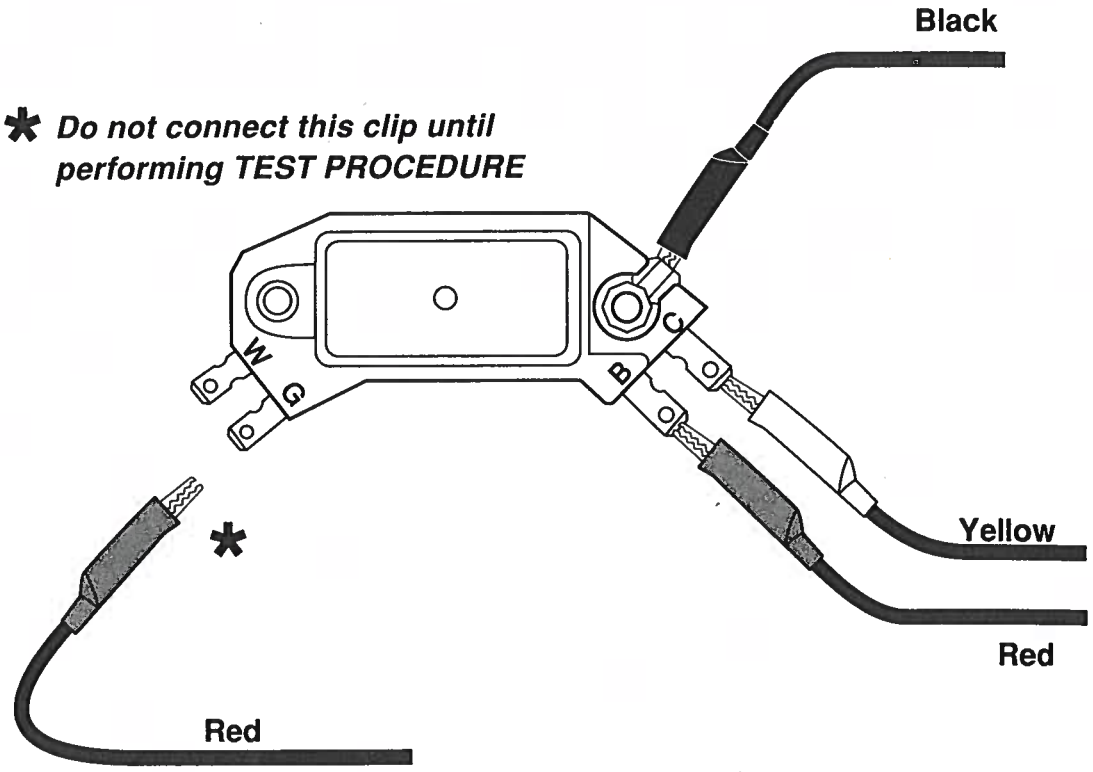
Ignition module must be removed from inside distributor before testing. This involves removing the distributor cap, rotor and module connections. Refer to vehicle service manual for procedure.

Make sure the special heat transfer compound is applied to the module's metal plate before re-installation.

Refer to Section 3, "Testing Sensors" for pick-up assembly checks. (See "Magnetic reluctance" or "Hall effect" type.)



Typical HEI Module Location



Set-Up (HEI 4-Pin module)

A) Perform steps in **Getting Started** on page **4-3.**

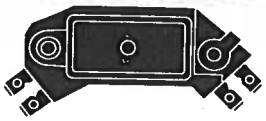
B) Set **POWER** switch to **OFF**.
Set **FUNCTION** switch to **SENSOR / MODULE**.

C) Connect **RED** test lead (either one) to module **Pin B** (battery "+").

D) Connect **YELLOW** test lead to module **Pin C** (ignition coil).

E) Clip jaw of **BLACK** test lead well into mounting hole on back side of module. (Slide back black insulator.) Connect to both metal plate and inside of mounting hole.

This completes the Set-Up. More connections are made during the Test Procedure. Refer to next page.



Test Procedure

This test checks the pick-up coil trigger circuit and ignition coil firing circuits inside the ignition module.

IMPORTANT: ***Modules vary! Your test results may differ slightly.***

Always check the 9 volt battery inside Sensor Tester Plus. (Refer to Section 2.)

Always make sure all connections are good. If necessary, scrape away corrosion, paint, etc. at the contact points.

1) **Perform SET-UP procedure.**

   Complete all steps (A through E) listed on opposite page.

2) **Set POWER switch to ON.**

   Both TEST lights should be OFF. If both lights are on brightly, the ignition module is defective.

3) **Connect loose RED test lead to module Pin G.**

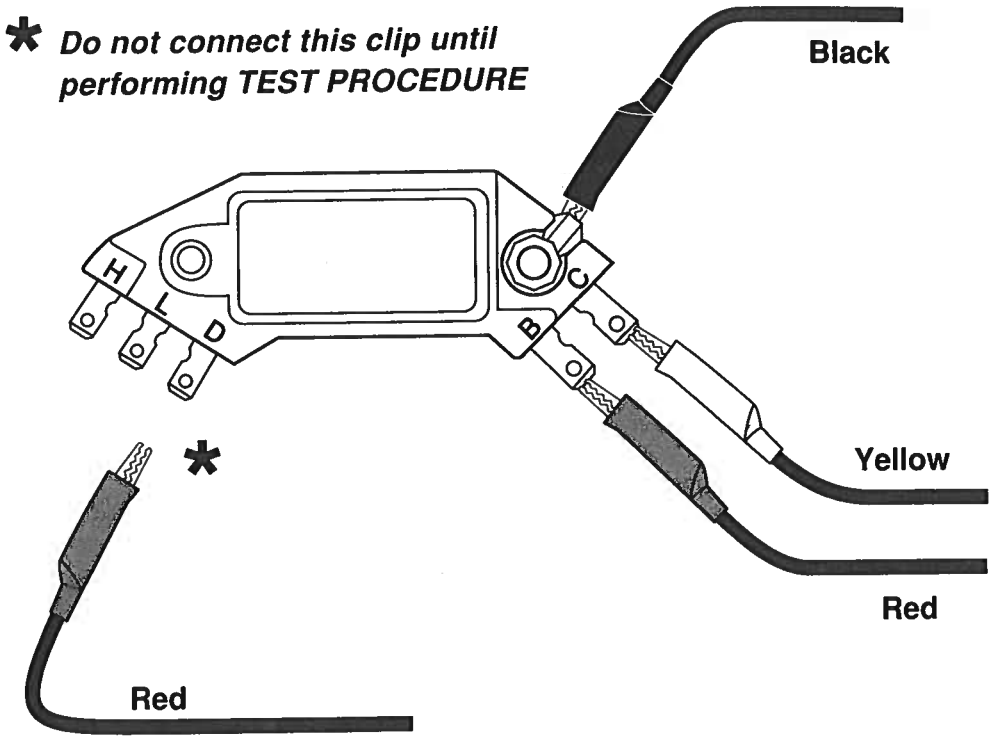
   Both TEST lights should turn ON brightly (there may be a short delay).

   Remove the RED test lead from module Pin G.

   Both TEST lights should turn back OFF (there may be a short delay).

   Both TEST lights should turn ON whenever the loose RED test lead touches module Pin G, then turn back OFF when the test lead is removed. If this does not happen, the ignition module is defective.

4) Testing is complete. Set POWER switch to OFF and remove all test leads.



Set-Up (HEI 5-Pin module)

A) Perform steps in **Getting Started** on page **4-3.**

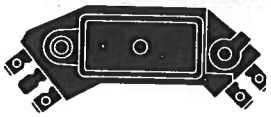
B) Set **POWER** switch to **OFF**.
Set **FUNCTION** switch to **SENSOR / MODULE**.

C) Connect **RED** test lead (either one) to module **Pin B** (battery "+").

D) Connect **YELLOW** test lead to module **Pin C** (ignition coil).

E) Clip jaw of **BLACK** test lead well into mounting hole on back side of module. (Slide back black insulator.) Connect to both metal plate and inside of mounting hole.

This completes the Set-Up. More connections are made during the Test Procedure. Refer to next page.



Test Procedure

(HEI 5-Pin module)

This test checks the pick-up coil trigger circuit and ignition coil firing circuits inside the ignition module.

IMPORTANT: ***Modules vary! Your test results may differ slightly.***

Always check the 9 volt battery inside Sensor Tester Plus. (Refer to Section 2.)

Always make sure all connections are good. If necessary, scrape away corrosion, paint, etc. at the contact points.

1) **Perform SET-UP procedure.**

   Complete all steps (A through E) listed on opposite page.

2) **Set POWER switch to ON.**

   Both TEST lights should be OFF. If both lights are on brightly, the ignition module is defective.

3) **Connect loose RED test lead to module Pin D.**

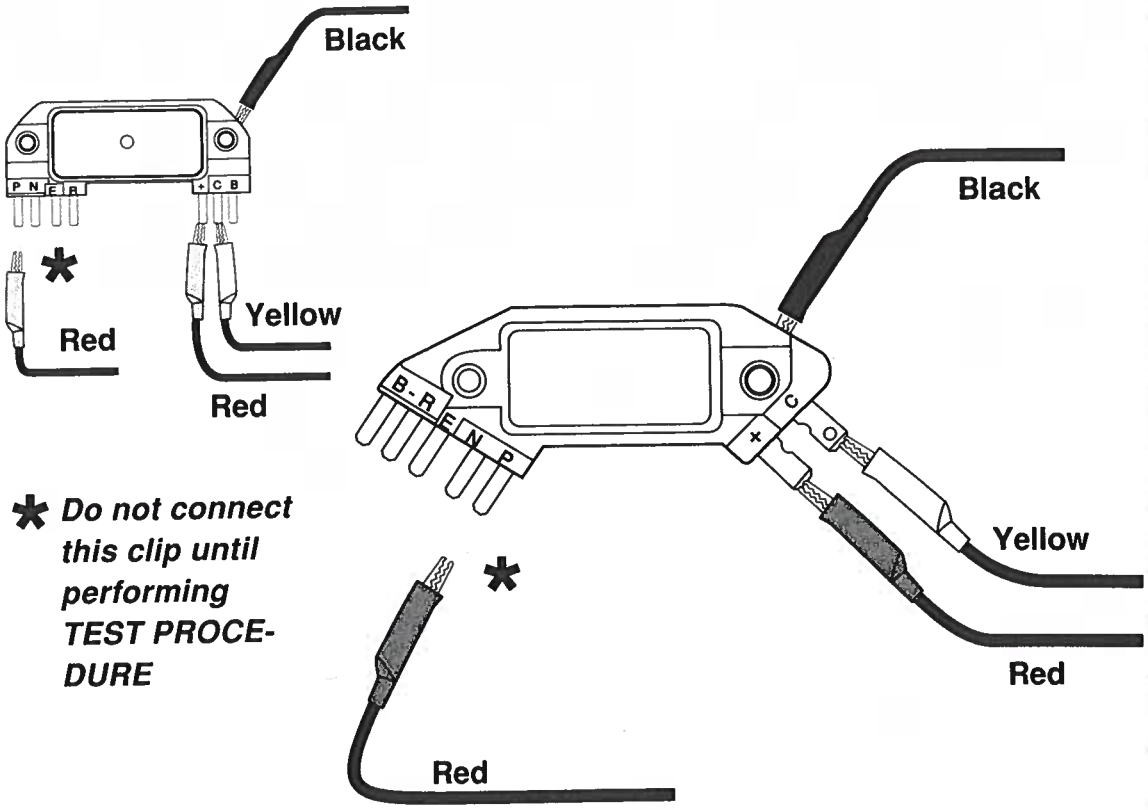
   Both TEST lights should turn ON brightly (there may be a short delay).

   Remove the RED test lead from module Pin D.

   Both TEST lights should turn back OFF (there may be a short delay).

   Both TEST lights should turn ON whenever the loose RED test lead touches module Pin D, then turn back OFF when the test lead is removed. If this does not happen, the ignition module is defective.

4) Testing is complete. Set POWER switch to OFF and remove all test leads.



* ***Do not connect this clip until performing TEST PROCEDURE***

Set-Up for Test Procedure Part 1 (HEI 7-Pin module)

IMPORTANT: There are several versions of the 7-Pin module which look different from the typical one illustrated above. The pins are always labeled as shown, but they may be in different positions on the various modules. All these modules use the same procedure. Make all connections based on **pin names**.

A) Perform steps in **Getting Started** on page **4-3.**

B) Set **POWER** switch to **OFF**.
Set **FUNCTION** switch to **SENSOR / MODULE**.

C) Connect **RED** test lead (either one) to module **Pin +** (battery "+").

D) Connect **YELLOW** test lead to module **Pin C** (ignition coil).

E) Clip jaw of **BLACK** test lead well into mounting hole on back side of module. (Slide back black insulator.) Connect to both metal plate and inside of mounting hole.

This completes the Set-Up. More connections are made during the Test Procedure. Refer to next page.

Test Procedure: Part 1 of 2

(HEI 7-Pin module)

See page 4-11 for Test Procedure Part 2. Complete both test parts.

This test checks the pick-up coil trigger circuit and ignition coil firing circuits inside the ignition module.

IMPORTANT: ***Modules vary! Your test results may differ slightly.***
Always check the 9 volt battery inside Sensor Tester Plus. (Refer to Section 2.)
Always make sure all connections are good at the contact points.

1) **Perform SET-UP procedure.**

   Complete all steps (A through E) listed on opposite page.

2) **Set POWER switch to ON.**

   Both TEST lights should be OFF. If both lights are on brightly, the ignition module is defective.

3) • **Set POWER switch to OFF.**

   • Disconnect BLACK test lead from metal plate.

   • Connect loose RED test lead to module Pin P.

4) **Set POWER switch to ON.**

   Both TEST lights should be OFF. If both lights are on brightly, the ignition module is defective.

5) **Reconnect BLACK test lead to metal plate in back of module.**

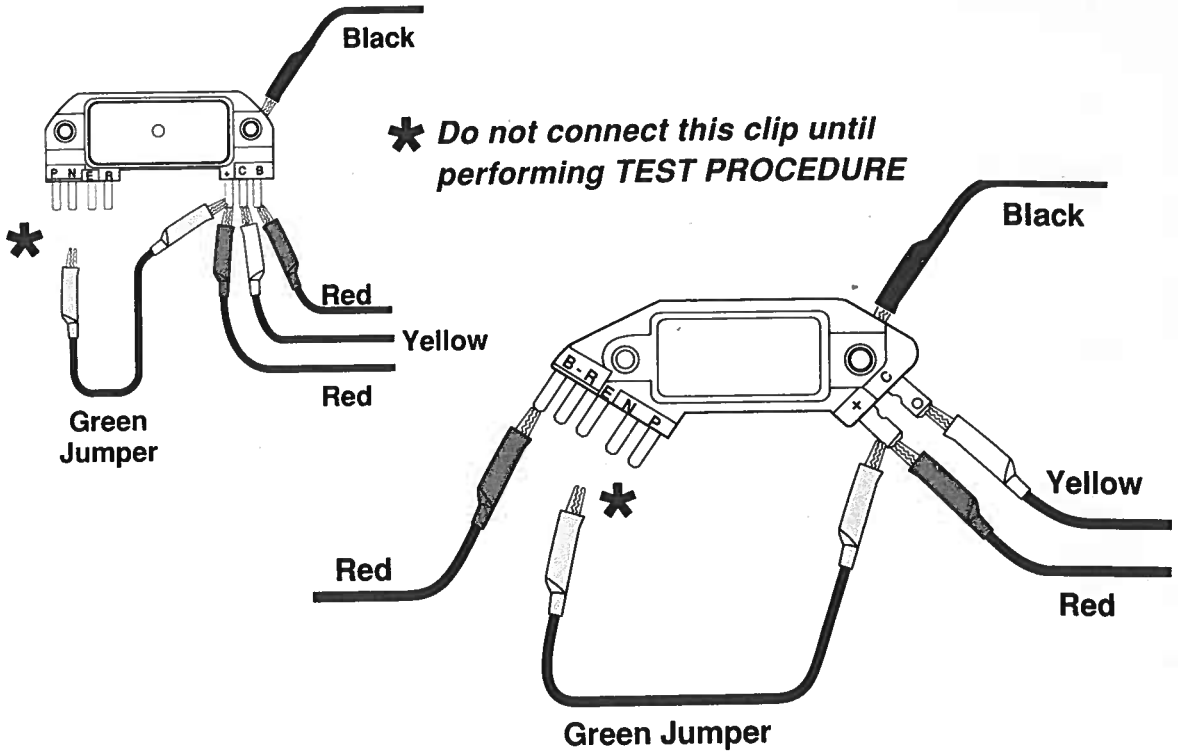
   Both TEST lights should turn ON brightly (there may be a short delay).

   Remove BLACK test lead from metal plate in back of module.

   Both TEST lights should turn back OFF.

   Both TEST lights should turn ON whenever the BLACK test lead touches module metal plate, then turn back OFF when the lead is removed. If this does not happen, the ignition module is defective.

6) Testing is complete. Set POWER switch to OFF and remove all test leads.



Set-Up for Test Procedure Part 2 (HEI 7-Pin module)

IMPORTANT: There are several versions of the 7-Pin module which look different from the typical one illustrated above. The pins are always labeled as shown, but they may be in different positions on the various modules. All these modules use the same procedure. Make all connections based on **pin names**.

A) Perform steps in **Getting Started** on page **4-3.**

B) Set **POWER** switch to **OFF**.
Set **FUNCTION** switch to **SENSOR / MODULE**.

C) Connect **RED** test lead (either one) to module **Pin B** (bypass).

D) Connect **YELLOW** test lead to module **Pin C** (ignition coil).

E) Clip jaw of **BLACK** test lead well into mounting hole on back side of module. (Slide back black insulator.) Connect to both metal plate and inside of mounting hole.

F) Connect second **RED** test lead to module **Pin +** (battery "+").

G) Connect one end of **GREEN** jumper lead to module **Pin +** (battery "+").

(Both the Red lead and the Green jumper are now attached to Pin +.)

This completes the Set-Up. More connections are made during the Test Procedure. Refer to next page.

Test Procedure: Part 2 of 2

See page 4-9 for Test Procedure Part 1. Complete both test parts.

This checks electronic spark timing and RPM signal switch circuits in module.

IMPORTANT: ***Modules vary! Your test results may differ slightly.***
Always check the Tester battery. (Refer to Section 2.)
Always make sure all connections are good at the contact points.

1) **Perform SET-UP procedure.**
   Complete all steps (A through G) listed on opposite page.

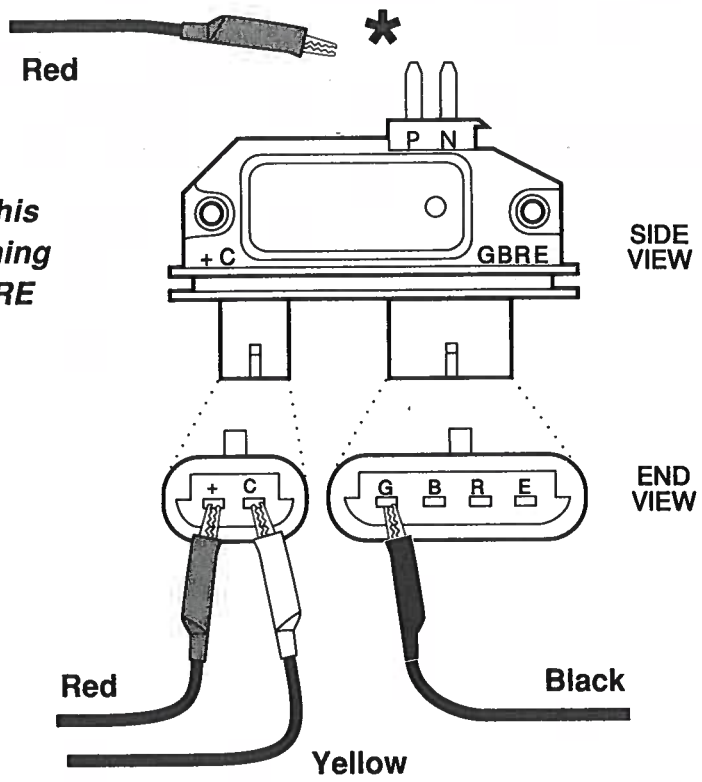
2) **Set POWER switch to ON.**
   Both TEST lights should be OFF. If both lights are on brightly, the ignition module is defective.

3) **Connect loose end of GREEN jumper to module Pin E.**
   Both TEST lights should turn ON brightly.
   Remove loose end of GREEN jumper from module Pin E.
   Both TEST lights should turn back OFF.
   Both TEST lights should turn ON whenever the loose GREEN jumper touches module Pin E, then turn back OFF when the jumper lead is removed. If the lights just flash or fail to turn on, the ignition module is defective.

4) **Connect loose end of GREEN jumper to module Pin P.**

5) **Connect module Pin R to module Pin E.** (Carefully touch both pins at the same time with a paper clip.)
   Both TEST lights should turn ON brightly.
   Disconnect module Pin R from module Pin E. (Remove paper clip.)
   Both TEST lights should turn back OFF.
   Both TEST lights should turn ON whenever Pin R and Pin E are connected together, then turn back OFF when the connection is removed. If the lights just flash or fail to turn on, the ignition module is defective.

6) Testing is complete. Set POWER to OFF. Remove all leads.



* ***Do not connect this clip until performing TEST PROCEDURE***

Set-Up for Test Procedure Part 1 (HEI 8-Pin module)

A) Perform steps in **Getting Started** on page **4-3**.

NOTE: Care must be used when attaching test leads to the closely spaced module pins. Connections can be made more easily using pin adapters. Refer to Section 2 for details.

B) Set **POWER** switch to **OFF**.

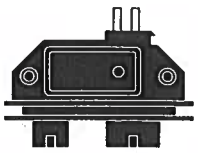
Set **FUNCTION** switch to **SENSOR / MODULE**.

C) Connect **RED** test lead (either one) to module **Pin +** (battery "+").

D) Connect **YELLOW** test lead to module **Pin C** (ignition coil).

E) Connect **BLACK** test lead to module **Pin G** (circuit ground.)

This completes the Set-Up. More connections are made during the Test Procedure. Refer to next page.



Test Procedure: Part 1 of 2

See page 4-15 for Test Procedure Part 2. Complete both test parts.

This test checks the pick-up coil trigger circuit and ignition coil firing circuits inside the ignition module.

IMPORTANT: ***Modules vary! Your test results may differ slightly.***

Always check the 9 volt battery inside Sensor Tester Plus. (Refer to Section 2.)

Always make sure all connections are good at the contact points.

1) **Perform SET-UP procedure.**

   Complete all steps (A through E) listed on opposite page.

2) **Set POWER switch to ON.**

   Both TEST lights should be OFF. If both lights are on brightly, the ignition module is defective.

3) • **Set POWER switch to OFF.**

   • Disconnect BLACK test lead from module Pin G.

   • Connect loose RED test lead to module Pin P.

4) **Set POWER switch to ON.**

   Both TEST lights should be OFF. If both lights are on brightly, the ignition module is defective.

5) **Reconnect BLACK test lead to module Pin G.**

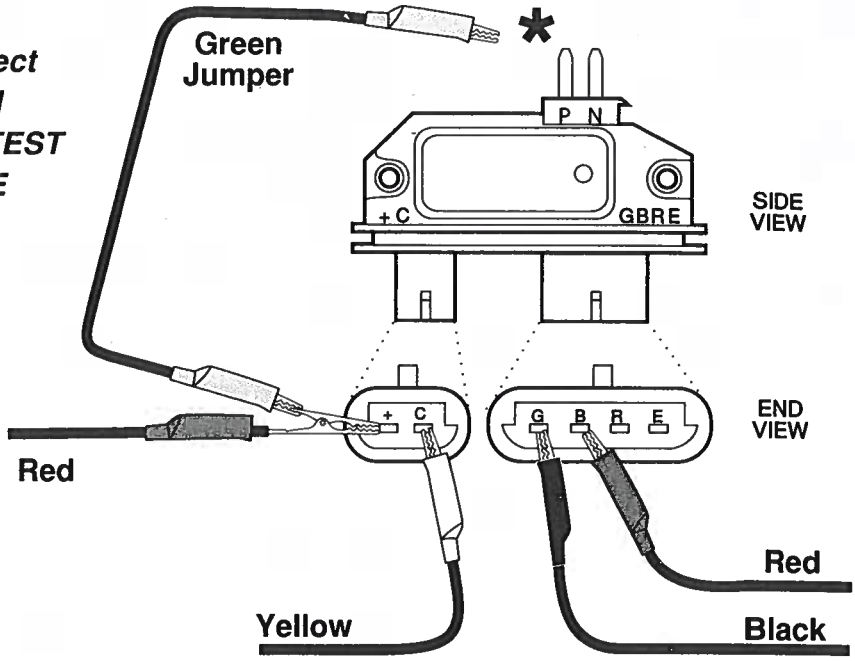
   Both TEST lights should turn ON brightly (there may be a short delay).

   Remove BLACK test lead from module Pin G.

   Both TEST lights should turn back OFF.

   Both TEST lights should turn ON whenever the BLACK test lead touches module Pin G, then turn back OFF when the test lead is removed. If this does not happen, the ignition module is defective.

6) Testing is complete. Set POWER switch to OFF and remove all test leads.



Set-Up for Test Procedure Part 2 (HEI 8-Pin module)

A) Perform steps in **Getting Started** on page **4-3**.

NOTE: Care must be used when attaching test leads to the closely spaced module pins. Connections can be made more easily using pin adapters, especially for steps E and F. Refer to Section 2 for details.

B) Set **POWER** switch to **OFF**.
Set **FUNCTION** switch to **SENSOR / MODULE**.

C) Connect **RED** test lead (either one) to module **Pin B** (bypass.)

D) Connect **YELLOW** test lead to module **Pin C** (ignition coil).

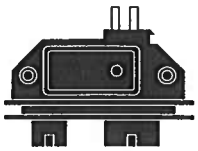
E) Connect **BLACK** test lead to module **Pin G** (circuit ground.)

F) Connect second **RED** test lead to module **Pin +** (battery +).

NOTE: Slide insulator back away from test clip before attachment to module.

G) Connect one end of **GREEN** jumper lead to bare test clip attached to module **Pin +**. (Both the Red lead and the Green jumper are now attached to Pin +.)

This completes the Set-Up. More connections are made during the Test Procedure. Refer to next page.



Test Procedure: Part 2 of 2

See page 4-13 for Test Procedure Part 1. Complete both test parts.

This checks electronic spark timing and RPM signal switch circuits in module.

IMPORTANT: ***Modules vary! Your test results may differ slightly.***
Always check Tester battery. (Refer to Section 2.)
Always make sure all connections are good at the contact points.

1) **Perform SET-UP procedure.**

   Complete all steps (A through G) listed on opposite page.

2) **Set POWER switch to ON.**

   Both TEST lights should be OFF. If both lights are on brightly, the ignition module is defective.

3) **Connect loose end of GREEN jumper to module Pin E.**

   Both TEST lights should turn ON brightly.

   Remove loose end of GREEN jumper from module Pin E.

   Both TEST lights should turn back OFF.

   Both TEST lights should turn ON whenever the loose GREEN jumper touches module Pin E, then turn back OFF when the jumper lead is removed. If the lights just flash or fail to turn on, the ignition module is defective.

4) **Connect loose end of GREEN jumper to module Pin P.**

5) **Connect module Pin R to module Pin E.** (Carefully touch both pins at the same time with a paper clip.)

   Both TEST lights should turn ON brightly.

   Disconnect module Pin R from module Pin E. (Remove paper clip.)

   Both TEST lights should turn back OFF.

   Both TEST lights should turn ON whenever Pin R and Pin E are connected together, then turn back OFF when the connection is removed. If the lights just flash or fail to turn on, the ignition module is defective.

6) Testing is complete. Set POWER to OFF. Remove all leads.

Ford Dura-Spark Ignition System

Overview

The Dura-Spark Ignition System was introduced in 1977 and used extensively until the mid '80's. The Dura-Spark system replaces breaker points with a pick-up assembly (magnetic reluctance type) and ignition module. The basic function of the module is to receive a signal from the pick-up, then energize the ignition coil to fire the spark plugs. The distributor houses the pick-up assembly and has a vacuum advance mechanism.

There are several module types. They all have the same size housing, but use various connectors (2 or 3) and have different color plastic grommets (where the wires enter the module).

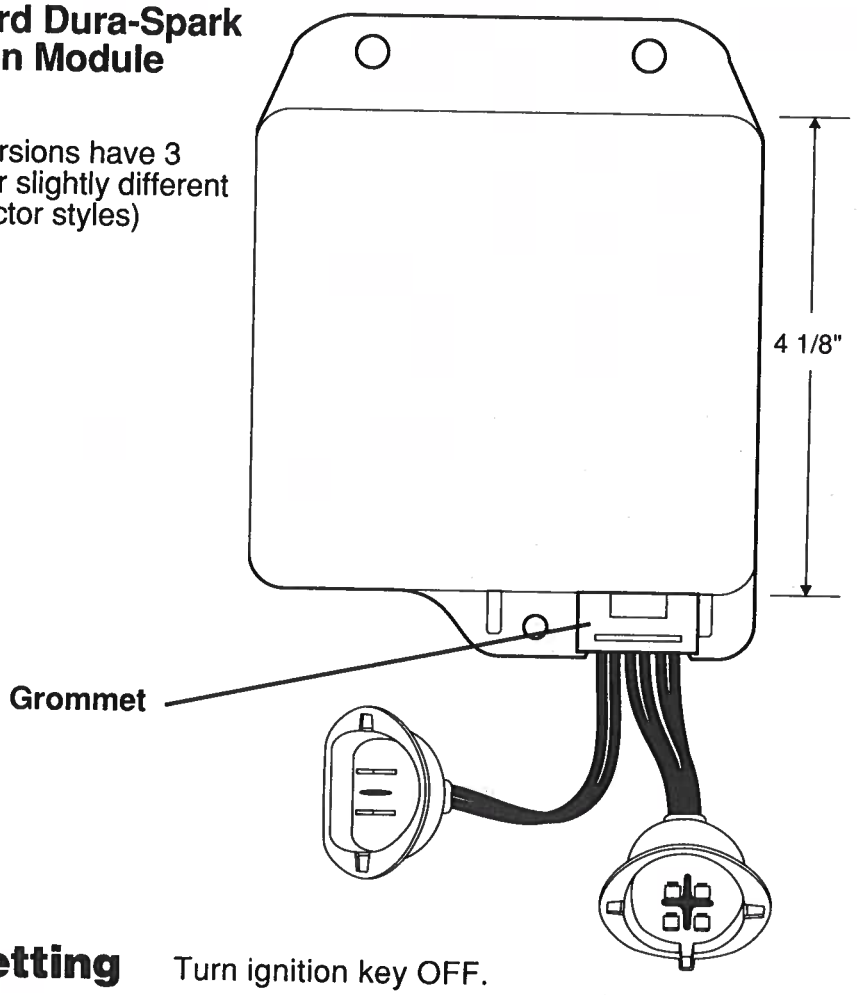
Vehicles with an EEC-I, EEC-II or EEC-III engine computer control system have distributors with no vacuum advance mechanism. The computer receives the pick-up signal, determines proper spark timing, then sends a signal back to the module to energize the coil. These systems have the pick-up mounted on the crankshaft rather than inside the distributor.

Location

The ignition module is typically located on the fender wall inside the engine compartment.

Typical Ford Dura-Spark Ignition Module

(Other versions have 3 connectors or slightly different connector styles)



Getting Started

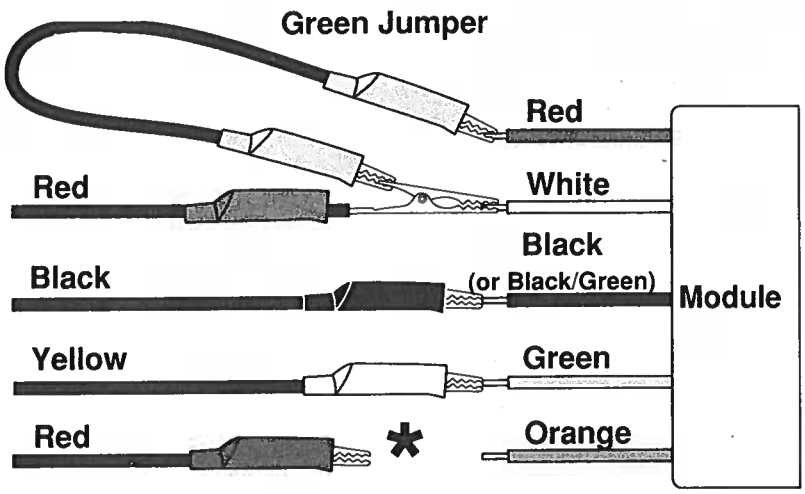
Turn ignition key OFF.

Disconnect wiring harness from ignition module. Inspect for corrosion or damage.

A special grease may be present on connector. Do not remove grease. It blocks moisture to stop corrosion.

Module may stay mounted on vehicle while testing only if reliable connections can be made to Sensor Tester Plus. Otherwise, remove module before proceeding.

Refer to Section 3, "Testing Sensors" for pick-up assembly checks. (See "Magnetic reluctance" type.)



Other module wires not used for testing

* ***Do not connect this clip until performing TEST PROCEDURE.***

Set-Up (All Dura-Spark styles. Module connectors not shown.)

Note: This module has several versions with different connector types. Make connections based on ignition module wire colors.

A) Perform steps in **Getting Started** on page **4-17**.

B) Set **POWER** switch to **OFF**.
Set **FUNCTION** switch to **SENSOR / MODULE**.

C) Connect **RED** test lead (either one) to module **WHITE** wire pin ("Start" power). **NOTE:** Slide insulator back away from test clip before attachment to module.

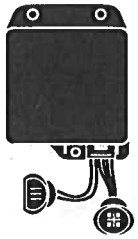
D) Connect one end of **GREEN** jumper lead to bare test clip attached to module **WHITE** wire pin. (Both the RED lead and the GREEN jumper are now attached to module WHITE wire pin.)

E) Connect loose end of **GREEN** jumper to module **RED** wire pin ("Run" power).

F) Connect **YELLOW** test lead to module **GREEN** wire pin (ignition coil).

G) Connect **BLACK** test lead to module **BLACK** (or Black/Green) wire pin (circuit ground).

This completes the Set-Up. More connections are made during the Test Procedure. Refer to next page.



Test Procedure

(All Dura-Spark ignition module styles.)

This test checks the pick-up coil trigger circuit and ignition coil firing circuits inside the ignition module.

IMPORTANT: ***Modules vary! Your test results may differ slightly.***

Always check the 9 volt battery inside Sensor Tester Plus. (Refer to Section 2.)

Always make sure all connections are good. If necessary, scrape away corrosion, paint, etc. at the contact points.

1) **Perform SET-UP procedure.**

   Complete all steps (A through G) listed on opposite page.

2) **Set POWER switch to ON.**

   Both TEST lights should be ON brightly. If the lights are dim or off, the ignition module is defective.

3) **Touch loose RED test lead to module ORANGE wire pin.**

   Depending upon the module type, both TEST lights should turn OFF or blink OFF then come back ON again. The blink may be very rapid.

   Remove loose RED test lead from module ORANGE wire pin.

   Both TEST lights should be ON brightly.

   Repeat entire Step 3 a few times to verify TEST light action. If the TEST lights do not turn off and on as described in this step, the ignition module is defective.

4) Testing is complete. Set POWER switch to OFF and remove all test leads.

Ford TFI (Thick Film Ignition) System

Overview

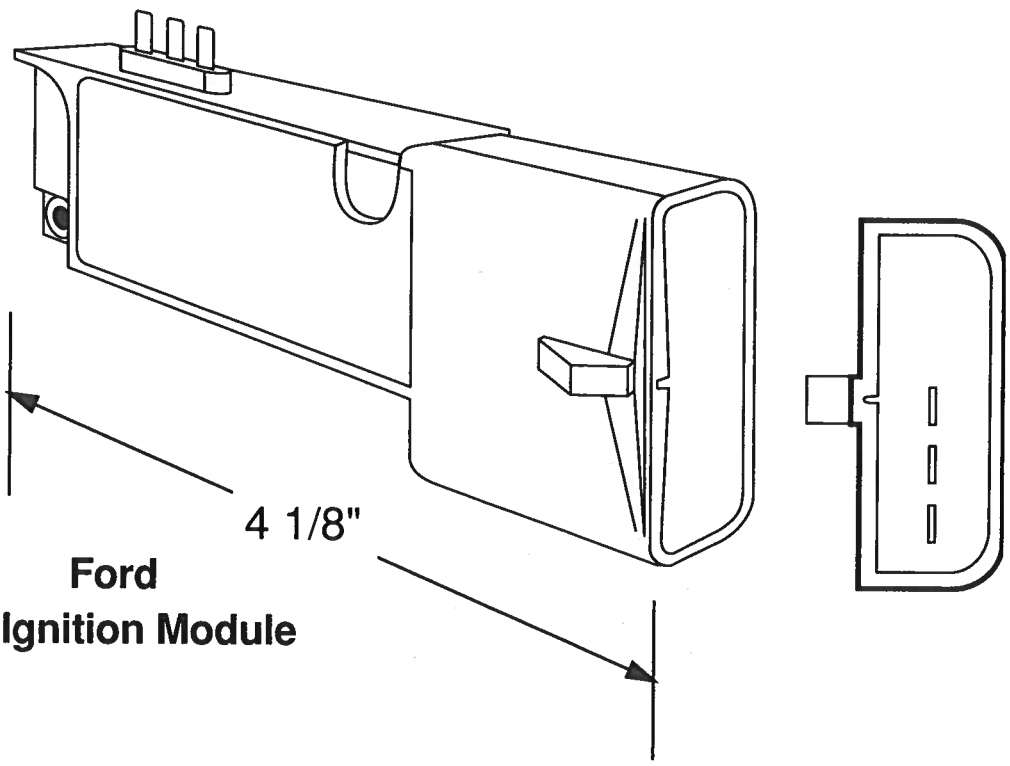
The TFI Ignition System was used from 1982 to 1985 in limited applications. (1.6L and 1.9L non-computer controlled engines.) This system replaces breaker points with a pick-up assembly (magnetic reluctance type) and ignition module. The basic function of the module is to receive a signal from the pick-up, then energize the ignition coil to fire the spark plugs. The distributor houses the pick-up assembly and has a vacuum advance mechanism.

The module has two connectors. The 3 pin top connector plugs into the distributor and attaches to the pick-up assembly. The 3 pin end connector attaches to battery power and ignition coil circuits.

Do not confuse this module with the widely used TFI-IV type. The TFI-IV module has 6 pins in the end connector, rather than 3, and operates quite differently.

Location

The ignition module is mounted to the base of the distributor, underneath the bowl.



Ford
TFI Ignition Module

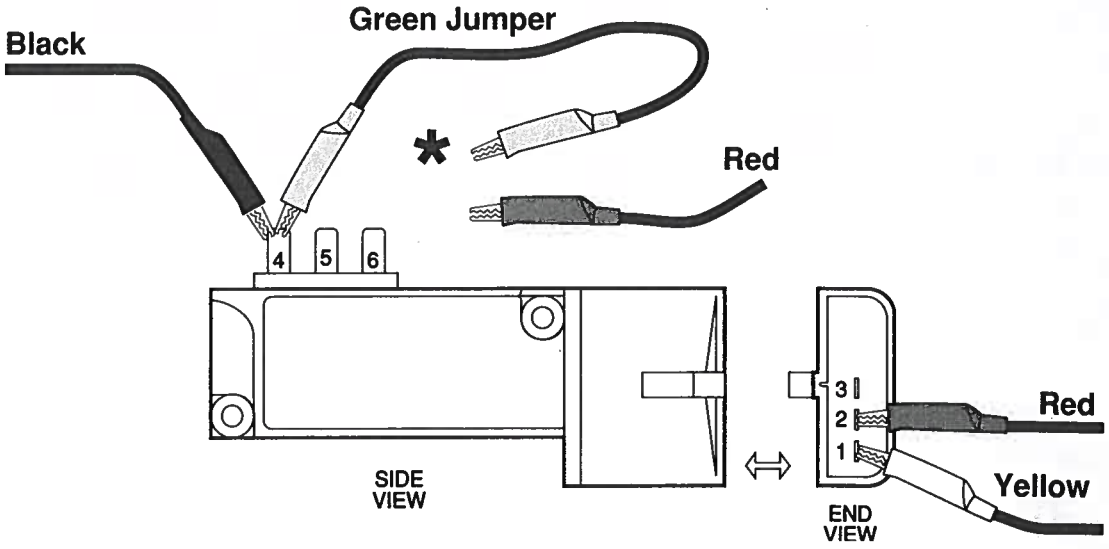
Getting Started

Ignition module must be removed from the distributor before testing. Refer to vehicle service manual for procedure. Improper handling during removal can damage the module connector pins which plug into the underside of the distributor bowl.

Make sure the special heat transfer compound is applied to the module's metal plate before re-installation. (Ford No. D7AZ19A331-A or equivalent.)

Refer to Section 3, "Testing Sensors" for pick-up assembly checks. (See "Magnetic reluctance" type.)

✱ ***Do not connect this clip until performing TEST PROCEDURE.***



Set-Up (TFI module)

A) Perform steps in **Getting Started** on page **4-21**.

B) Set **POWER** switch to **OFF**.
Set **FUNCTION** switch to **SENSOR / MODULE**.

C) Connect **RED** test lead (either one) to module **Pin 2** ("Run" circuit).

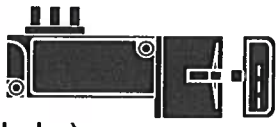
D) Connect **YELLOW** test lead to module **Pin 1** (ignition coil).

E) Connect **BLACK** test lead to module **Pin 4** (circuit ground).

F) Connect one end of **GREEN** jumper lead to module **Pin 4** (circuit ground).

(Both the Black lead and the Green jumper are now attached to Pin 4.)

This completes the Set-Up. More connections are made during the Test Procedure. Refer to next page.



Test Procedure (TFI module)

This test checks the coil pick-up trigger circuit and ignition coil firing circuits inside the ignition module.

IMPORTANT: ***Modules vary! Your test results may differ slightly.***
Always check the 9 volt battery inside Sensor Tester Plus. (Refer to Section 2.)
Always make sure all connections are good. If necessary, clean contact points.

1) **Perform SET-UP procedure.**
   Complete all steps (A through F) listed on opposite page.

   NOTE: Ignore the action of the Lower TEST light in this entire procedure.

2) **Set POWER switch to ON.**
   Upper TEST light should be OFF. If the upper TEST light is on brightly, the ignition module is defective.

3) **Touch loose RED test lead to module Pin 5.**
   Upper TEST light should flash ON brightly for about 1/2 second, then turn off again.

   If no flashing occurs, touch the loose RED test lead to module **Pin 6** instead.

   If the flash occurs, go to Step 4. (Remove any connections to either Pin 5 or 6.)

   If the upper TEST light still does not flash, the ignition module is defective.

4) **Touch loose end of GREEN jumper to module Pin 6.**
   Upper TEST light should flash ON brightly for about 1/2 second, then turn off again.

   If no flashing occurs, touch the loose green jumper to module **Pin 5** instead and watch for the flash to happen.

   If the upper TEST light still does not flash, the ignition module is defective.

   NOTE: This entire step may be repeated a few times to verify flashing action.

5) Testing is complete. Set POWER switch to OFF and remove all test leads.

Ford TFI-IV
(Thick Film Ignition, version 4)

Overview

The TFI-IV Ignition System was introduced in 1983. It is used on all engines controlled by the EEC-IV computer system. This system replaces breaker points with a pick-up assembly (Hall effect type) and ignition module. The engine computer controls spark timing. The pick-up signal goes to the computer. The computer determines correct spark timing, then sends a signal back to the module to energize the ignition coil. The distributor has no vacuum advance mechanism.

There are 2 module housing types. The distributor mount version has both a 3 pin top connector and a 6 pin end connector. The remote mount version only has the 6 pin end connector.

Location

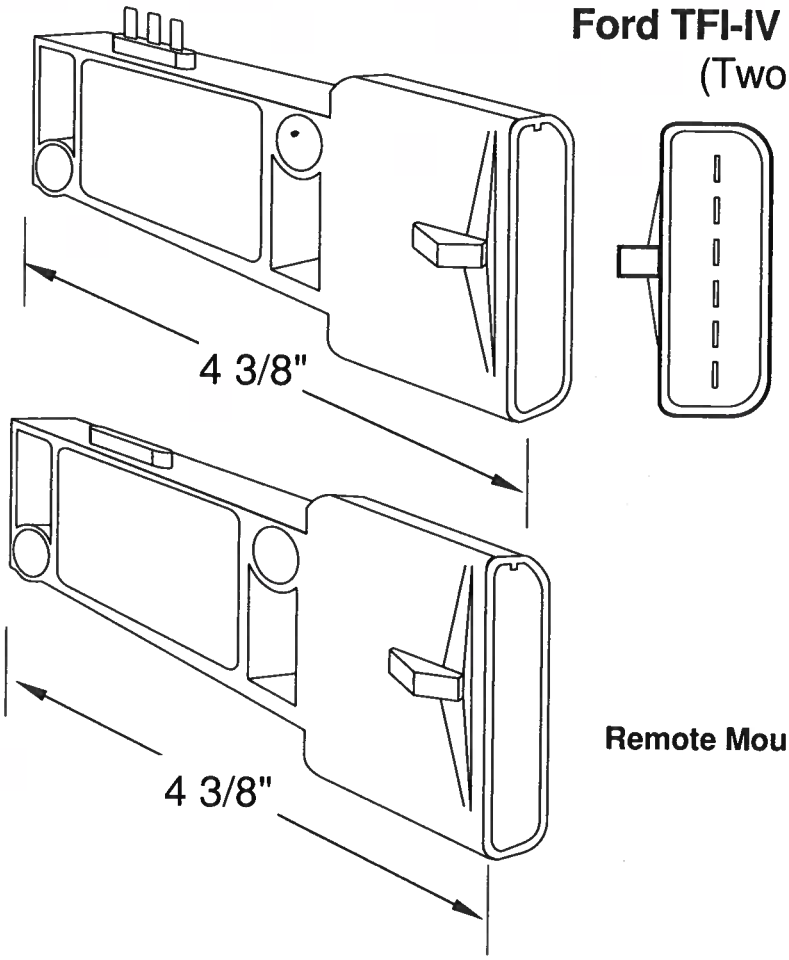
Distributor Mount Version:

This module is mounted to the base of the distributor, underneath the bowl.

Remote Mount Version:

This module is typically mounted high up on the firewall and partially concealed by a shroud. This module can also be mounted elsewhere, including the base of the distributor.

Ford TFI-IV Ignition Module
(Two versions shown)



Distributor Mount

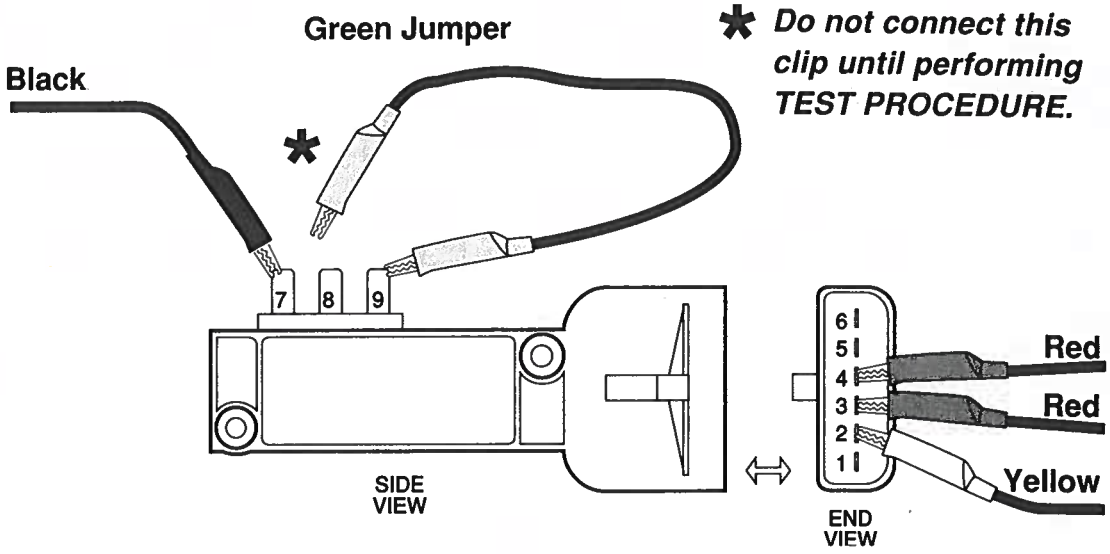
Remote Mount

Getting Started

Ignition module must be removed from vehicle before testing. Refer to vehicle service manual for procedure. Improper handling during removal (distributor mount version) can damage the module connector pins which plug into the underside of the distributor bowl.

Make sure the special heat transfer compound is applied to the module's metal plate before re-installation. (Ford No. D7AZ19A331-A or equivalent.)

Refer to Section 3, "Testing Sensors" for pick-up assembly checks. (See "Hall effect" type.)



Set-Up (TFI-IV module, Distributor Mount version)

A) Perform steps in **Getting Started** on page **4-25**.

B) Set **POWER** switch to **OFF**.

Set **FUNCTION** switch to **SENSOR / MODULE**.

C) Connect **RED** test lead (either one) to module **Pin 4** ("Start" or "Filtered Tach" circuit).

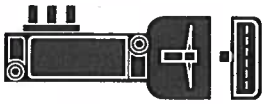
D) Connect remaining **RED** test lead to module **Pin 3** ("Run" circuit).

E) Connect **YELLOW** test lead to module **Pin 2** (ignition coil).

F) Connect **BLACK** test lead to module **Pin 7** (circuit ground).

G) Connect one end of **GREEN** jumper lead to module **Pin 9** ("PIP" – the distributor pick-up signal).

This completes the Set-Up. More connections are made during the Test Procedure. Refer to next page.



Test Procedure

(TFI-IV module, Distributor Mount version)

This test checks the Hall pick-up trigger circuit and ignition coil firing circuits inside the ignition module.

IMPORTANT: **Modules vary! Your test results may differ slightly from those described below.**

Always check the 9 volt battery inside Sensor Tester Plus. (Refer to Section 2.)

Always make sure all connections are good. If necessary, scrape away corrosion, paint, etc. at the contact points.

1) **Perform SET-UP procedure.**

   Complete all steps (A through G) listed on opposite page.

2) **Set POWER switch to ON.**

   Upper TEST light should be OFF. If the upper TEST light is on brightly, remove RED test lead from module Pin 4 for remainder of test. Upper TEST light should now be OFF. If upper light is still ON, the ignition module is defective.

3) **Touch loose end of GREEN jumper to module Pin 7.**

   Upper TEST light should turn ON then OFF, or just stay ON (depends upon module type).

   Remove GREEN jumper from module Pin 7.

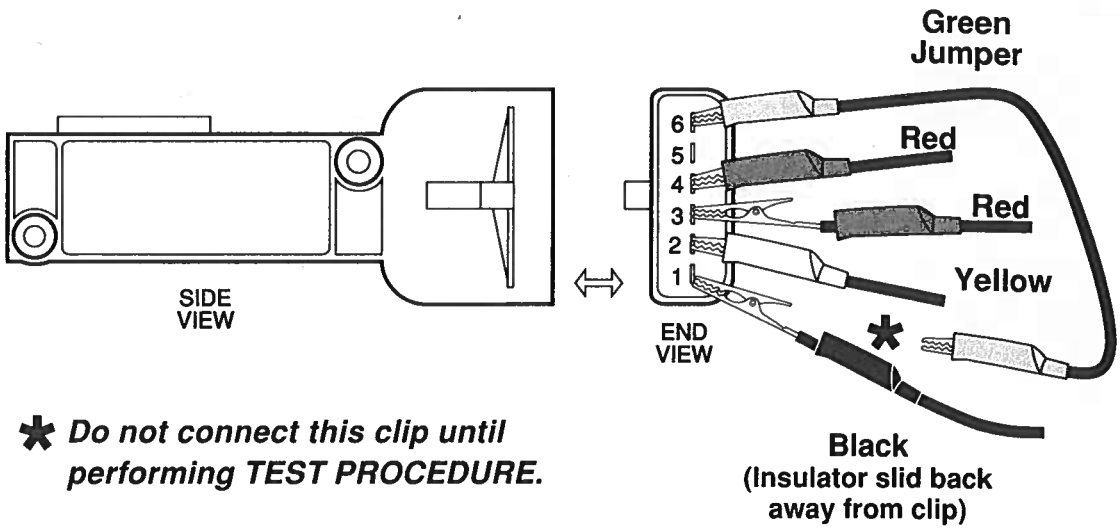
   Upper TEST light should be OFF. (Lower TEST light may be on or off.)

   If the TEST lights do not turn on and off as described, touch loose end of GREEN jumper to module Pin 8 instead, and look for the same type of TEST light action.

   If the TEST lights still do not turn on and off, the ignition module is defective.

   Repeat entire step 3 a few times to verify results.

4) Testing is complete. Set POWER switch to OFF and remove all test leads.



* ***Do not connect this clip until performing TEST PROCEDURE.***

Set-Up (TFI-IV module, Remote Mount version)

A) Perform steps in **Getting Started** on page **4-25**.

B) Set **POWER** switch to **OFF**.
Set **FUNCTION** switch to **SENSOR / MODULE**.

C) Connect **RED** test lead (either one) to module **Pin 4** ("Start" or "Filtered Tach" circuit).

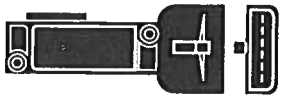
D) Connect remaining **RED** test lead to module **Pin 3** ("Run" circuit). **NOTE:** Slide insulator back away from test clip before attachment to module.

E) Connect **YELLOW** test lead to module **Pin 2** (ignition coil).

F) Connect **BLACK** test lead to module **Pin 7** (circuit ground).
NOTE: Slide insulator back away from test clip before attachment to module.

G) Connect one end of **GREEN** jumper lead to module Pin 6. ("PIP" – the distributor pick-up signal).

This completes the Set-Up. More connections are made during the Test Procedure. Refer to next page.



Test Procedure

(TFI-IV module, Remote Mount version)

This test checks the Hall pick-up trigger circuit and ignition coil firing circuits inside the ignition module.

IMPORTANT: **Modules vary! Your test results may differ slightly from those described below.**

Always check the 9 volt battery inside Sensor Tester Plus. (Refer to Section 2.)

Always make sure all connections are good. If necessary, scrape away corrosion, paint, etc. at the contact points.

1) **Perform SET-UP procedure.**

   Complete all steps (A through G) listed on opposite page.

2) **Set POWER switch to ON.**

   Upper TEST light should be OFF. If the upper TEST light is on brightly, remove RED test lead from module Pin 4 for remainder of test. Upper TEST light should now be OFF. If upper light is still ON, the ignition module is defective.

3) **Touch loose end of GREEN jumper to clip on module Pin 1.**

   Upper TEST light should turn ON then OFF, or just stay ON (depends upon module type).

   Remove GREEN jumper from clip on module Pin 1.

   Upper TEST light should be OFF. (Lower TEST light may be on or off.)

   If the TEST lights do not turn on and off as described, touch loose end of GREEN jumper to clip on module Pin 3 instead, and look for the same type of TEST light action.

   If the TEST lights still do not turn on and off, the ignition module is defective.

   Repeat entire step 3 a few times to verify results.

4) Testing is complete. Set POWER switch to OFF and remove all test leads.

Section 4 Testing Ignition Modules

Overview

The EIS Ignition System was introduced in 1972 and used extensively. It was gradually replaced with computer controlled spark systems as Federal emission standards became more strict. The EIS system replaces breaker points with a pick-up assembly (either magnetic reluctance or Hall effect type) and ignition module. There are two module types.

4-Pin or *5-Pin using Magnetic Reluctance Pick-Up:* Performs basic function. Receives a signal from the pick-up inside the distributor and energizes the ignition coil to fire the spark plugs. Distributor has vacuum advance mechanism.

5-Pin using Hall Effect Pick-Up: Same function as above, but using a Hall effect pick-up instead of a magnetic reluctance type. Module shape and connector design are also different. Distributor has vacuum advance mechanism.

Location

The ignition module is typically located on the fire wall or wheel well inside the engine compartment.

Getting Started

Turn ignition key OFF.

Disconnect wiring harness from ignition module. Inspect for corrosion or damage.

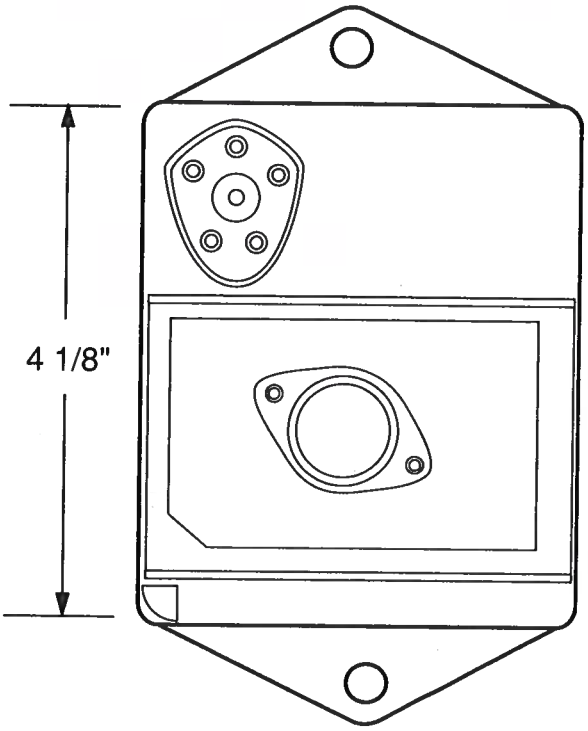
A special grease may be present on connector. Do not remove grease. It blocks moisture to stop corrosion.

Module may stay mounted on vehicle while testing only if reliable connections can be made to Sensor Tester Plus. Otherwise, remove module before proceeding.

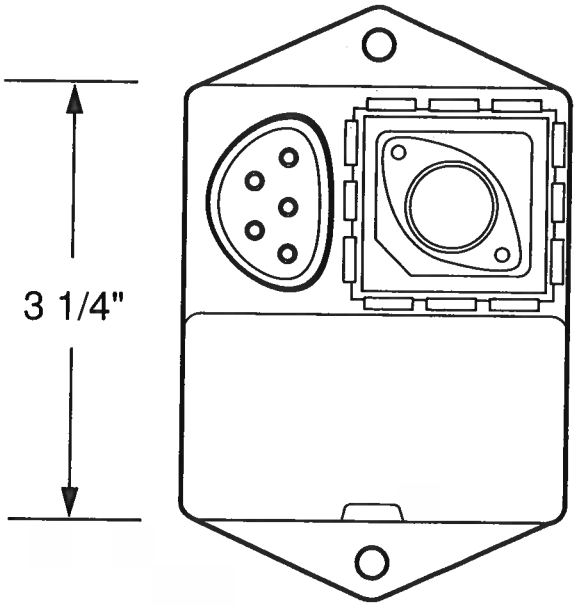
Refer to Section 3, "Testing Sensors" for pick-up assembly checks. (See "Magnetic reluctance" or "Hall effect" type.)

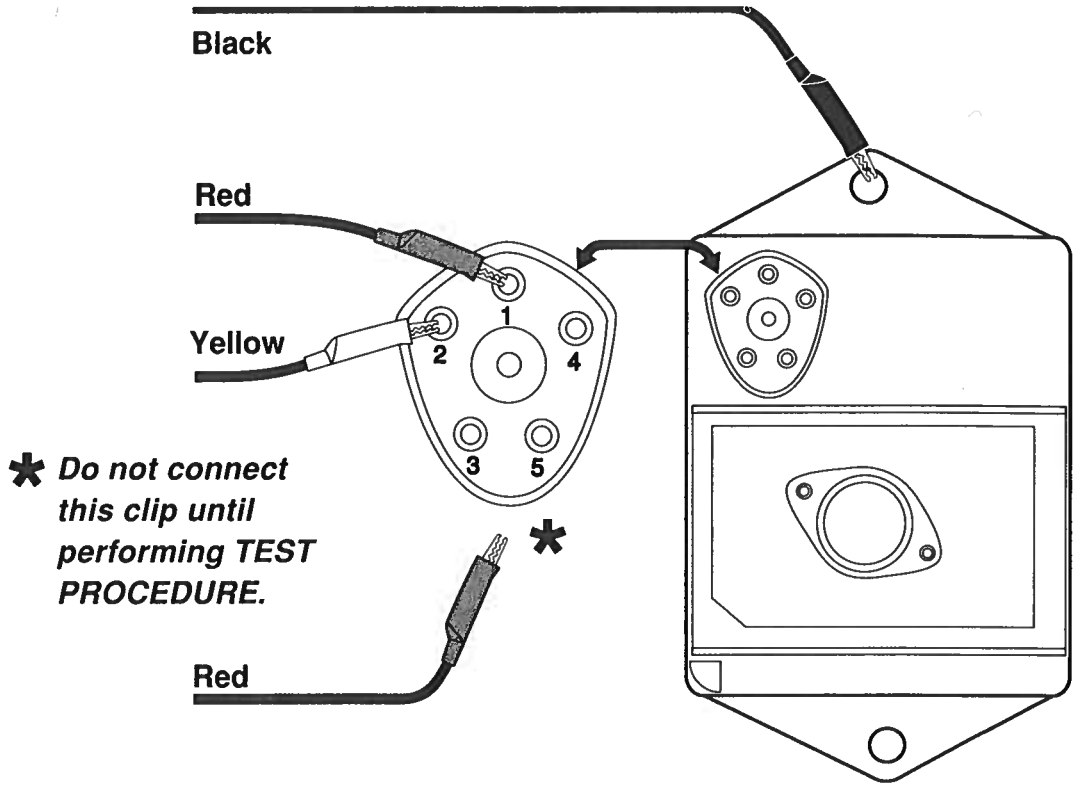
Chrysler 5-pin EIS module – Reluctance Pick-up

(4-pin version is similar)



Chrysler 5-pin EIS module – Hall Pick-up





Set-Up (EIS 4-Pin or 5-Pin, Reluctance Pick-up)

A) Perform steps in **Getting Started** on page **4-30**.

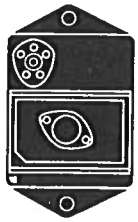
B) Set **POWER** switch to **OFF**.
Set **FUNCTION** switch to **SENSOR / MODULE**.

C) Connect **RED** test lead (either one) to module **Pin 1** (battery "+").

D) Connect **YELLOW** test lead to module **Pin 2** (ignition coil).

E) Connect **BLACK** test lead to module **mounting flange** (circuit ground). *Do not* connect black test lead to transistor case, transistor mounting screws or "U" shaped metal heat dissipator under transistor. These pieces are *not* connected to circuit ground.

This completes the Set-Up. More connections are made during the Test Procedure. Refer to next page.



Test Procedure

(For either 4-Pin or 5-Pin modules with reluctance pick-up.)

This test checks the pick-up coil trigger circuit and ignition coil firing circuits inside the ignition module.

IMPORTANT: ***Modules vary! Your test results may differ slightly.***

Always check the 9 volt battery inside Sensor Tester Plus. (Refer to Section 2.)

Always make sure all connections are good. If necessary, scrape away corrosion, paint, etc. at the contact points.

1) **Perform SET-UP procedure.**

   Complete all steps (A through E) listed on opposite page.

2) **Set POWER switch to ON.**

   Both TEST lights should be ON brightly. If the lights are dim or off, the ignition module is defective.

3) **Connect loose RED test lead to module Pin 5.**

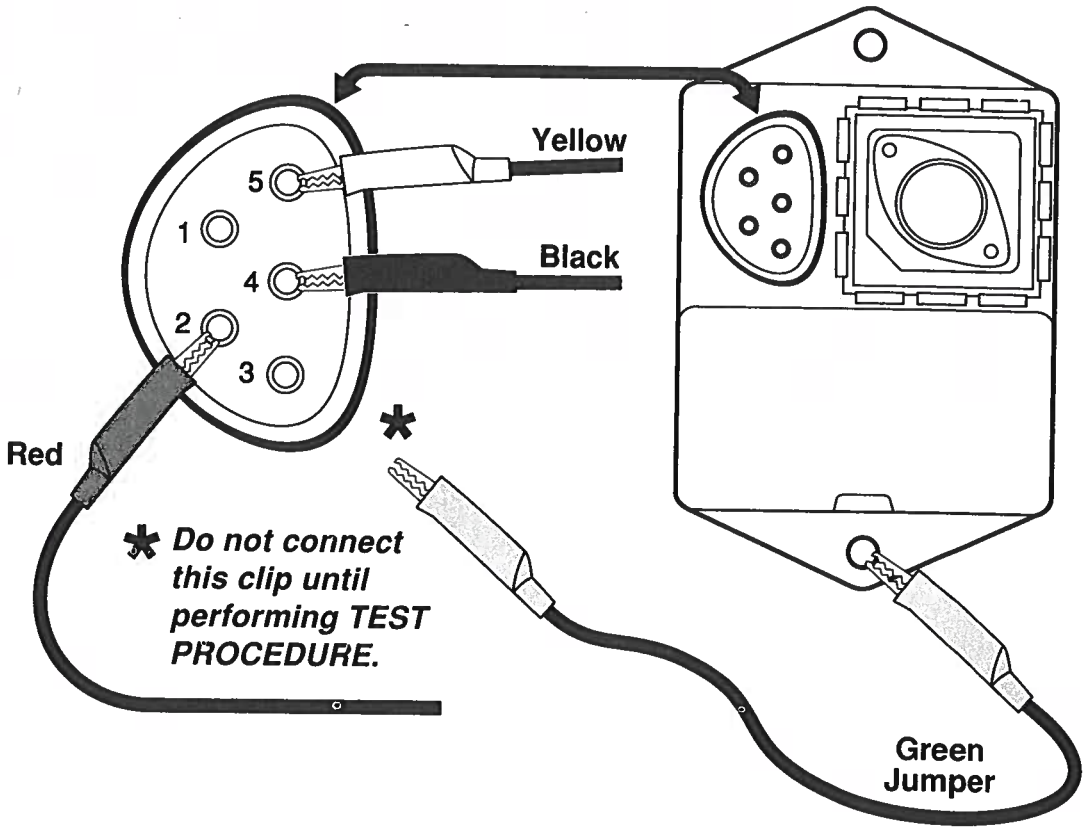
   Upper TEST light should turn OFF (there may be a short delay). Lower TEST light may be off or on.

   Remove the RED test lead from module Pin 5.

   Both TEST lights should turn back ON (there may be a short delay).

   Upper TEST light should turn OFF whenever the loose RED test lead touches module Pin 5, then come back ON when the test lead is removed. If this does not happen, the ignition module is defective.

4) Testing is complete. Set POWER switch to OFF and remove all test leads.



Set-Up (EIS 5-Pin, Hall Pick-up)

A) Perform steps in **Getting Started** on page **4-30**.

B) Set **POWER** switch to **OFF**.
Set **FUNCTION** switch to **SENSOR / MODULE**.

C) Connect **RED** test lead (either one) to module **Pin 2** (battery "+").

D) Connect **YELLOW** test lead to module **Pin 5** (ignition coil).

E) Connect **BLACK** test lead to module **Pin 4** (circuit ground).

F) Connect one end of **GREEN** jumper lead to module **mounting flange** (circuit ground). ***Do not*** connect green jumper lead to transistor case, transistor mounting screws or "U" shaped metal heat dissipator under transistor.

This completes the Set-Up. More connections are made during the Test Procedure. Refer to next page.

Test Procedure

(EIS 5-Pin module with Hall pick-up.)

This test checks the Hall pick-up trigger circuit and ignition coil firing circuits inside the ignition module.

IMPORTANT: ***Modules vary! Your test results may differ slightly.***

Always check the 9 volt battery inside Sensor Tester Plus. (Refer to Section 2.)

Always make sure all connections are good. If necessary, scrape away corrosion, paint, etc. at the contact points.

1) **Perform SET-UP procedure.**

   Complete all steps (A through F) listed on opposite page.

2) **Set POWER switch to ON.**

   Both TEST lights should be OFF. (The lights may flash on briefly - this is O.K.) If the lights remain on after a few seconds, the ignition module is defective.

3) **Momentarily touch module Pin 3 with loose end of GREEN jumper.**

   Both TEST lights should flash ON for about one second (and then turn off) as the loose end of the GREEN jumper is removed from module Pin 3. This step may be repeated a few times to verify the flashing action.

   Whenever the TEST lights are off, tapping module Pin 3 with the loose GREEN jumper should cause the lights to flash ON for about one second. If this does not happen, the ignition module is defective.

4) Testing is complete. Set POWER switch to OFF and remove all test leads.

Notes

Section 5

Testing DC Idle Speed Control Motors

What is It?

This is a 2-wire dc motor with a movable plunger shaft which acts as a throttle stop. The motor can move the plunger forwards, backwards or keep it in one position. A mechanical switch is built into the plunger assembly. This "idle tracking" switch is activated whenever the throttle rests against the plunger.

How is it Used?

The computer uses the motor to maintain idle when the engine is cold, hot or under load (such as air conditioning on). The motor can also act as a dashpot (slows down throttle closure at sudden deceleration), anti-diesel control and prepositioning for next start-up. The idle tracking switch signals the computer when the throttle lever rests against it. The computer then controls the motor as necessary to achieve proper idle speed.

Location

The idle speed control motor is located on the outside of the carburetor or throttle body, close to the throttle linkage.

When to Check

Related trouble codes sent by computer. Driveability problems such as hard starting, stalling, rough idle, erratic idle, cold engine warm-up problems, dieseling (run-on).

What to Inspect

Motor operation (see next page). Poor connections at the motor or computer. Open or short circuits in harness wiring, binding throttle shaft or linkage, binding "cruise control" linkage, mis-adjusted mounting bracket or throttle stop, vacuum leaks, ignition timing.

Test Procedure – Motor

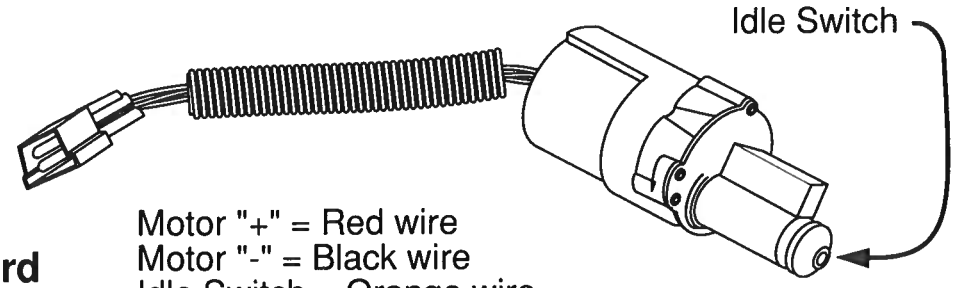
NOTE: Checking may be done on-car if test leads can be reliably connected to idle speed motor. Otherwise, remove idle speed motor from vehicle before testing.

IMPORTANT: Always check Tester battery (Sec. 2).

Warning: Observe all safety precautions when working on a vehicle (see page iv).

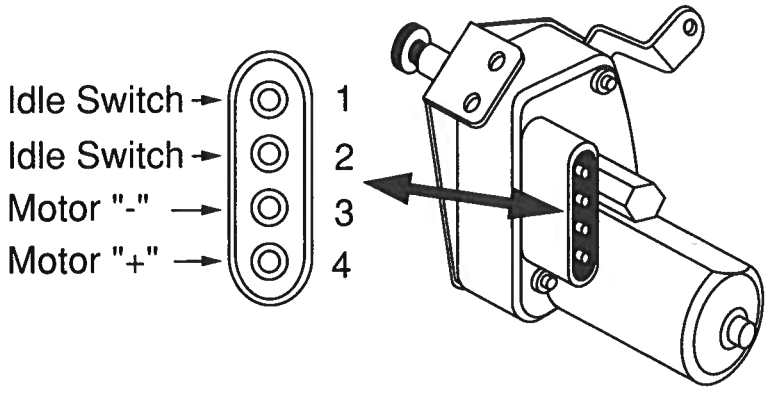
1) Set POWER switch to OFF.
2) Set FUNCTION switch to SENSOR/MODULE.
3) Disconnect wire harness from motor connector. Inspect for damage.
4) Connect RED test lead to Motor "+" pin.
5) Connect BLACK test lead to motor "-" pin.
6) Make sure metal clips make good contact and do not touch each other.

Ford



Motor "+" = Red wire
Motor "-" = Black wire
Idle Switch = Orange wire
Idle Switch = Purple wire

GM



Testing DC Idle Speed Control Motors

7) Set POWER switch to ON.
- Motor plunger should EXTEND. Note: Plunger may already be fully extended.

8) Set POWER switch to OFF when plunger fully extended. (Motor will stall or make grinding, clicking noises.)

9) Reverse test lead connections...
- Connect RED test lead to Motor "-" pin.
- Connect BLACK test lead to motor "+" pin.

10) Set POWER switch to ON.
- Motor plunger should RETRACT.

11) Set POWER switch to OFF when plunger fully retracted. (Motor will stall or make grinding, clicking noises.)

12) Repeat Steps 3 through 11 a few times to verify results.
- Plunger should extend and retract smoothly and completely during testing.

13) Extend plunger at least half way out (for idle switch test). Set POWER switch to OFF and remove all test leads. Proceed to Idle Switch Test (see next page).

Test Procedure – Switch

(Continued from previous page.)

14) *Verify:*

POWER switch on OFF.

FUNCTION switch on SENSOR/MODULE.

15) Connect YELLOW test lead to either Idle Switch pin. (Refer to page 5-2 for locations.)

16) Connect BLACK test lead to remaining Idle Switch pin.

17) Make sure metal clips make good contact and do not touch each other.

18) Set POWER switch to ON.

On-Car testing only: Move and hold throttle linkage away from tip of plunger. Throttle must NOT be resting on plunger during next step.

19) Idle switch is activated by pressing (and holding) tip of plunger.

GM:

- Plunger released: Both TEST lights should be OFF.
- Press and hold tip of plunger - both TEST lights should turn ON.

Ford:

- Plunger released: Both TEST lights should be ON.
- Press and hold tip of plunger - both TEST lights should turn OFF.

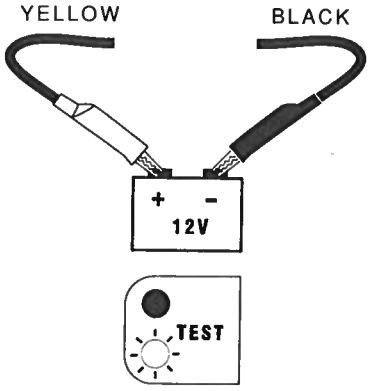
20) Repeat Step 19 several times to verify results. If the TEST lights do not respond as specified in Step 19, the idle motor is defective.

21) Testing is complete. Set POWER switch to OFF and remove all test leads.

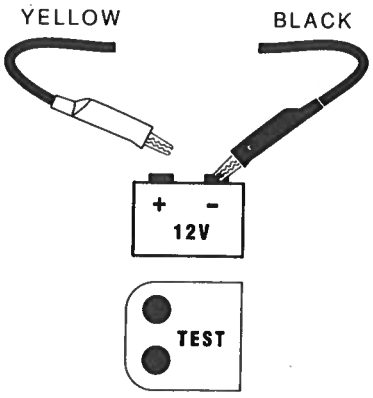
Section 6

More Uses for the Sensor Tester Plus

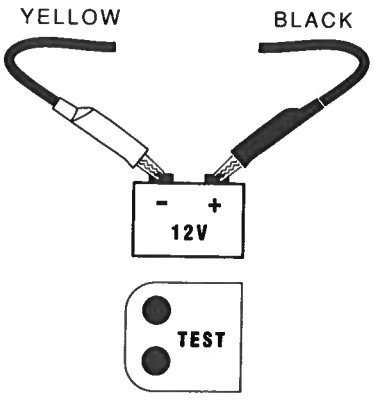
"Circuit Tester" Voltage Checks



Positive Volts



No Volts



Negative Volts

This function is useful for checking the presence (or absence) of voltages throughout the vehicle electrical system (such as wiring, switches, relays and connectors). Many vehicle service manuals use a "circuit tester" in their test procedures. The Sensor Tester Plus may be substituted in most cases.

Warning: Observe all safety precautions when working on-car (see page iv.)

1) Set POWER switch to OFF position. (FUNCTION switch may be on any position.)

2) Connect BLACK test lead to circuit ground.

3) Probe with YELLOW test lead.

Warning: Do not connect to secondary ignition circuits – dangerous voltages present!

4) Positive voltages applied to YELLOW test lead will light the lower TEST light. Larger voltages produce a brighter light.

- 12 volts or more = bright light.
- 4 volts or less = dim light, or off.

IMPORTANT:

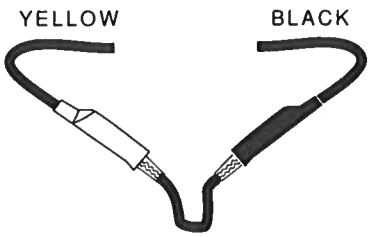
- The TEST light is low power – safe for computer circuits.
- Negative voltages, no matter how large, will NOT turn on the TEST light.
- Always make sure all connections are good at the contact points.

Continuity Checks

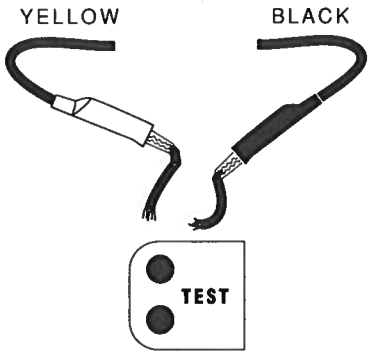
Test wiring, ground connections, switch operation, relay contacts, or similar.

Test unpowered circuits only.

Warning: If working on-car, turn ignition key OFF and observe all safety precautions (see page iv.)



Continuity
(Good Wire)



No Continuity
(Broken Wire)

1) Set POWER switch to ON position.

Set FUNCTION switch to SENSOR/MODULE position.

2) Use YELLOW and BLACK test leads:

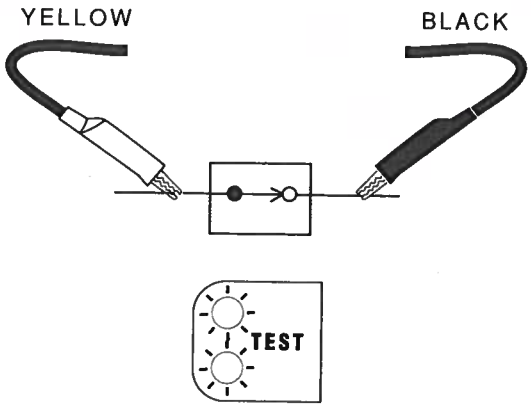
- Connect YELLOW test lead to one end of circuit (such as wire, switch, relay contact).
- Connect BLACK test lead to other end of wire, switch, relay.

3) Observe TEST lights:

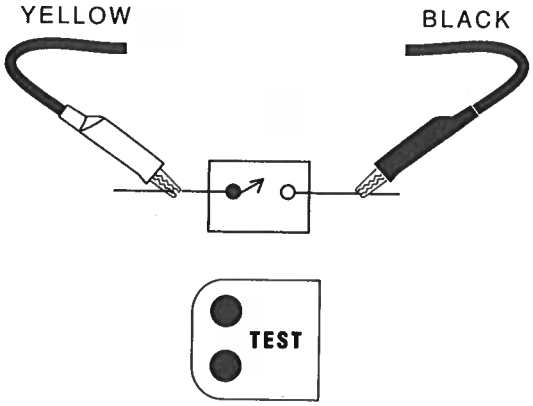
- Both TEST lights ON means continuity (continuous circuit) exists between Yellow and Black test leads.
- Both TEST lights OFF means no continuity (open circuit) exists between Yellow and Black test leads.

NOTE: Always make sure all connections are good. If necessary, scrape away corrosion, paint, etc. at the contact points.

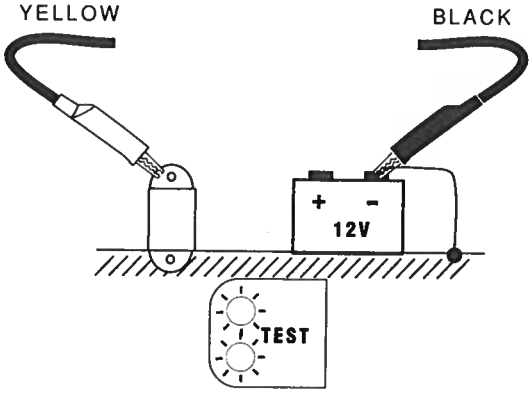
Continuity Checks (cont.)



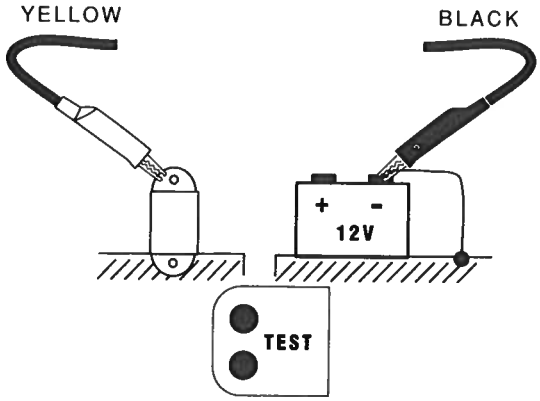
Switch Closed



Switch Open



Ground Connection



No Ground Connection

Diode Checks

Tests diodes and rectifiers for proper operation.

1) Set POWER switch to ON position.
Set FUNCTION switch to SENSOR/MODULE position.

2) Refer to Figure 1 below:
- Connect YELLOW test lead to anode end of diode.
- Connect BLACK test lead to cathode end of diode.

3) Both TEST lights should be ON. If the lights are off, the diode is defective.

4) Reverse test lead connections to diode. (Refer to Figure 2 below.)
- Connect YELLOW test lead to cathode end of diode.
- Connect BLACK test lead to anode end of diode.

5) Both TEST lights should be OFF. If the lights are on, the diode is defective.

NOTE: Always make sure all connections are good. If necessary, scrape away corrosion, paint, etc. at the contact points.

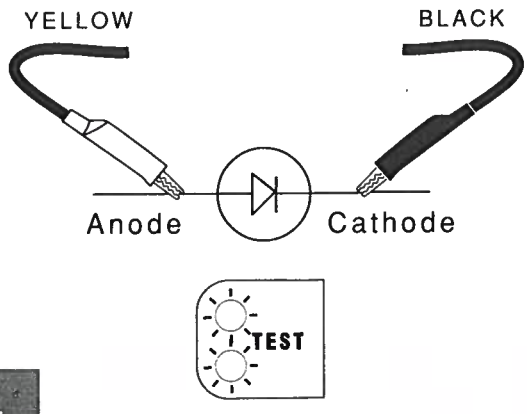


Figure 1

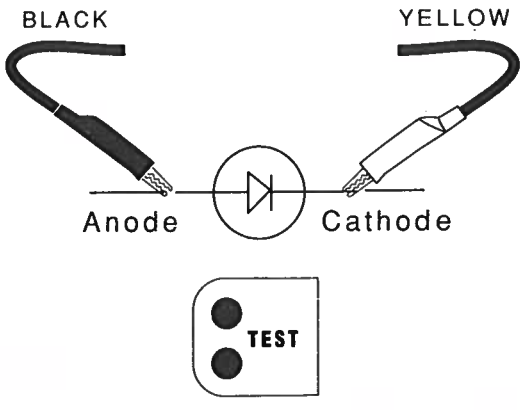


Figure 2

Sunpro® by actron

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Cleveland, Ohio 44102-4696

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